Factory Management and Maintenance

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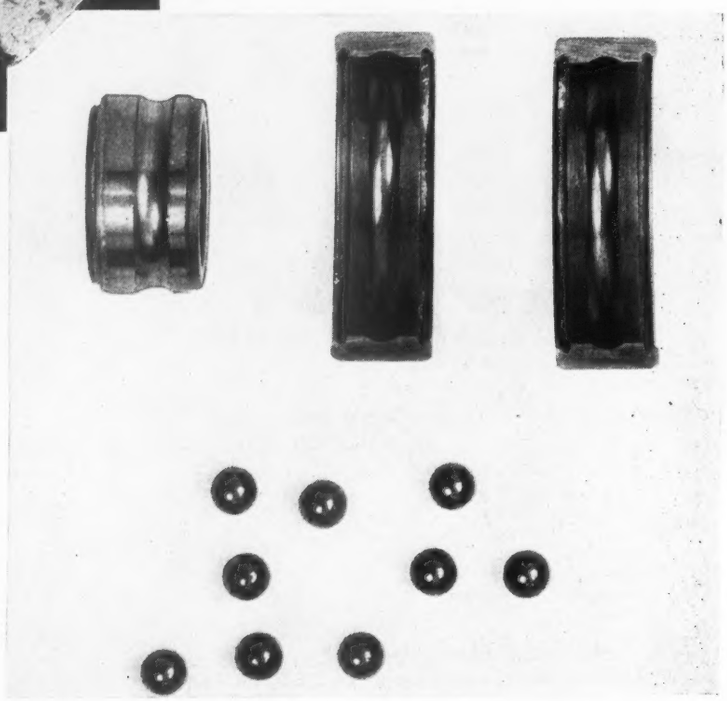

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Factory
Management and Maintenance
L. C. MORROW, EDITOR

The Fault Is with the Act

LAST MONTH brought to a new focus the National Labor Relations Act. In the case of the National Electric Products Company of Ambridge, Pa., the Labor Board, in defiance of a contract between the company and an AFL union, ordered an election to determine whether AFL or CIO should represent the employees. This despite a previous decision of a United States District Court declaring the contract valid and ordering its enforcement.

Cutting away the thick shell of technicalities that surrounds the kernel of this case, we find some very positive and disconcerting facts. The Act, written to extend the AFL, is difficult of administration because of the advent of the rival, and strong, CIO. The Labor Board, by the Act, is given too much power. The Act can be responsible for loss in employment, as well as financial loss to employers. There is little recognition by the Board of the need for taking account of practicalities and end-results in its administration of the Act.

It is a fairly common belief that the Board and its trial examiners have been acting as prosecutors rather than impartial judges of disputes between employers and unions. We feel that there is much justification for this belief, particularly concerning the examiners.

But it must be remembered that the law itself is frankly a law of partiality. It was written to promote union organization. It specifies unfair practices of employers only. It permits the Board to determine the employee unit for bargaining. It permits the Board to say that there shall or shall not be an election, to set the date of the election, to say who shall vote. It does not permit the Board to find labor guilty of anything.

WITH such a law it is to be expected that the administrators will be partial. It is to be expected that they will be zealous workers for organized labor. It is to be expected that they will act strictly within their own interpretation of the technicalities of the Act. It is to be expected that the necessarily large bureaucracy of administration will contain the prosecutor type of trial examiner.

And that brings us right back to our previously stated conclusion that the National Labor Relations Act should be amended to make it a law that will promote cooperation instead of strife between management and labor.

This management should strive to bring about while it makes every effort to abide by the law as it now stands.

Wanted–Men Who Can Fill Tomorrow's Jobs

One of industry's larger responsibilities today is the training of replacements. Carnegie-Illinois visualizes the importance of this task, builds up the manpower it needs for 1940 and the years ahead by launching a four-fold training program — one that will train apprentices, technical graduates, plant supervisors, and wage earners

ARTHUR VAN VLISSINGEN
Consulting Editor

Out of the experience of Carnegie-Illinois Steel Corporation

EMPLOYEES and employers have been through some hard years together. They have emerged into a period when once more industrial executives are justified in thinking of future developments as well as of present needs.

During depression years, with plants running far below capacity, almost every company and plant and man was concerned largely with the requirements of the current moment, and long-range planning along certain lines was placed in the category of deferred business.

This was true particularly of apprentice training. During the slack years employers as a rule concentrated rather on giving as much work as possible to men who urgently needed wages for livelihood.

It does not mean that training for the future was entirely lost sight of, or that much thought was not devoted to it. The reviving and expanding of the training program in the Carnegie-Illinois Steel Corporation, for instance, has its origin in the studies and experiences of the past. It is just now growing to mature stature.

Preparing for the Future

As employers, this company's executives are concerned with strengthening the future of the business. They recognize the close connection between the welfare of the employees and the welfare of the company itself. A strong thread of social consciousness runs through the conception and development of the work of preparing young men to assume positions of greater importance in future years.

The company believes that the men and women in its service should have the opportunity to develop their maximum capabilities for earning and for living. To the extent that the company can properly interest itself in the subject, the children of employees should have the chance to qualify themselves for the more desirable types of work at the company's disposal.

These goals naturally are coveted from the human standpoint. Also, the management believes it is feasible to work toward them by routes that are commercially as well as socially justified.

Carnegie-Illinois has not as yet encountered a shortage of skilled employees of the trades required in the steel business. But the management sees that a shortage may be experienced in the near future. The knowledge does not come from guesswork, but from definite surveys conducted in the communities where the company has plants. Just when such a shortage may be felt, varies in different mill communities.

Surveying one plant, for instance, the management discovers that virtually all the electricians are in their early forties, and are sufficient in number. But a different situation exists as regards bricklayers. Many of the latter are near the age of retirement; there are few masons to be employed in the neighborhood. Plainly, a considerable number of them will have to be replaced in a few years.

Now that the situation has been determined rather precisely in each plant and its surrounding community, the company is training apprentices so they will be ready to step in when the opportunities develop in the years just ahead.

A skilled artisan cannot be developed overnight. The program is proceeding on the theory that a four-year course of training is needed, and for this reason what is being done today will not make itself felt in a major way until about 1940. It is clear that there is a need to make such training accessible to promising youngsters so that production, employment, and general prosperity may not be retarded.

It is to do its share in meeting these future needs that Carnegie-Illinois has entered into an expanded apprentice training program. This program is carefully designed to develop the needed number of skilled artisans, and is based on a normal expectancy of successful course completions and retention in the company's employ.

Training Now Coordinated

In past years the companies and individual plants which became the Carnegie-Illinois Steel Corporation had their own training methods, but there was a lack of coordination. Training chiefly was the concern of the individual plant, and methods varied considerably.

With the formation of this company from several subsidiaries of the United States Steel Corporation, the management studied the training problem systematically, and developed a plan in which the prospective training was divided into four broad lines of endeavor, each distinct from the others.

The first of these was apprentice training; the second, supplementary training for technical graduates planning careers in the operations department; the third, supervisory

Two of the twelve blast furnaces at Gary Works, Carnegie-Illinois Steel Corporation

NO SHORTAGE of skilled steelworkers — yet. But the Carnegie-Illinois management sees such a shortage somewhere in the offing. This knowledge is based, not on guesswork, but on surveys made in each of the industrial communities where the company has mills. Its training program has therefore been carefully cut to fit and fill future needs

training; fourth, all other classifications, including training on the job, instruction of immigrants desiring citizenship, trade extension course, and night schooling.

In this company's conception, the whole broad subject of personnel training today is at a point of development comparable, perhaps, to where the industrial safety movement stood 25 or 30 years ago. Veterans of industry—steel or any other—recall the deaths and injuries which in their youth were accepted almost as inevitable accompaniments of manufacturing, but which subsequent experience has shown were largely needless.

A Wasteful Situation

Carnegie-Illinois executives believe that a quarter of a century from now it will be equally difficult for the younger men to comprehend the casual handling of personnel training in the past. It is obviously wasteful to let the acquiring of mechanical skills "just grow" with a consequent excess of craftsmen at one plant and a shortage at another. Such a condition might correct itself in time, because the skilled workman naturally moves from place to place until he finds out where he fits best, but it is a wasteful, expensive situation.

In another division of the company has been placed the training of young aspirants to sales positions in the company. This, just as apprentice and other training, has developed over a considerable period.

The reasoning behind this program may be summed up in a few academic questions. What would be the cost of developing a competent salesman from the human raw material that comes to the company as a graduate of an engineering school, starts in plant operations, and eventually drifts into the sales department and makes good?

How much less is the cost of training this material deliberately for sales work, devoting thorough study to the entire line rather than to leave it to the man to expand from the intensive training he received only in learning the output of a single mill? How much would the company and the man himself gain during his normal life in the company by reason of giving him more thorough training in sales work and getting him started younger?

That is the Carnegie-Illinois conviction, and its program is proceeding along that line. Similar questions might be asked about the technical graduate who plans to remain an operations man; the answers probably would be the same.

The management cannot yet know the answers in dollars and cents from actual experience with its broad training program, but believes the evidence is all in favor of greater efficiency in the organization and greater earnings for the individuals who are trained instead of developed in a haphazard manner.

Just as certainly, Carnegie-Illinois executives feel that every industry that is not training its supervisors is losing substantial sums annually through less efficient and effective supervision.

It is difficult to measure the effects of having foremen lose their tact at times, or of having them operate solely on rule-of-thumb methods of determining how well production standards are being met. No one can know precisely what losses a company is suffering from such sources, but obviously they must be considerable in any plant.

The management has also been concerned about the waste of mental power arising from failure to profit by the miscellaneous adult education program that can be developed at little cost on the basis of percentage knowledge.

Last winter, at Youngstown, Ohio, about 1,200 of the 8,000 employees of the district were enrolled in night school classes. Part of this was due to an enlightened and cooperative school board. Much of it was due to active interest by the plant management, which helped to show the personnel the opportunities to be had in taking advantage of what the schools offered. Near the end of 1936 there were 35 vocational night school classes being held weekly in Youngstown, with instruction in 14 subjects by 22 instructors, of whom 17 were company executives.

There is not space in this article to itemize the details of Carnegie-Illinois training policies. Departments are set up for both the Pittsburgh and Chicago districts. A coordinator has been placed in each plant in charge of training activities. This is the framework upon which the training structure is being erected, and at present this represents the principal element of expense involved.

What Does It Cost?

The expense is considerable, but it is small in relation to the size of the business. Translating the set-up into terms of the average single-plant business, the company is building up a per plant cost only slightly greater than that of a single training supervisor. If the results do not far exceed this, then certainly it will be surprising.

The apprentice training courses number eleven trades, and have been worked out in detail so that they may be carried on in uniform effectiveness in all plants and mills. They are predicated on putting the

Machinist apprentice learns how to run a small drill press at the Homestead Works of Carnegie-Illinois Steel Corporation

Embryo patternmaker supplements classroom theory with the actual shop experience so essential to mastery of his trade

youngsters to work at jobs where they can produce results to pay their way. This is not an enterprise for conducting free trade schools at company expense. Rather, the company is paying the apprentices liberal wages and expecting them to earn their way, and is contributing the theory and principles along with the practical training that go into the mastering of a trade.

Classroom work is contributed by men from the plant, supervisors, skilled workmen, or others. The lecturers are not "canned" material, but are delivered by local plant men working from outlines centrally supplied to assure covering the subject completely and systematically.

The apprentice training gives first preference to employees, second preference to sons of employees. The man must be at least 18 years old, must have the background and education and attitude which make probable his successful completion of the course.

300 Apprentices in Training

He starts out at slightly more than 90 per cent of the base pay for unskilled labor, and by keeping up to the standard required of apprentices is automatically raised in pay every six months, so that at the beginning of the eighth half-year he is drawing approximately 140 per cent of the base rate for labor. This, incidentally, virtually coincides with one of the class rates for skilled labor in these trades.

Approximately 300 young apprentices are now in training. The number of apprentices increases weekly, and presumably will increase steadily until the first four-year cycle is completed. The number is not, however, increased indiscriminately. The management is as eager to avoid a surplus as to forestall a shortage.

Enrollments are based closely upon the survey figures already referred to, so that with a normal expectancy of successful graduates from the course, and a normal expectancy of separations from skilled labor forces due to illness, old-age retirements, and other causes, the situation should keep in balance.

In the training of technical graduates, a definite separation exists between the mill training of young men intended for sales department work and those intending to continue in operations work. With both of these groups, however, the basic policy is diametrically opposed to that of the apprentice training.

Here the policy is to give the technical graduates the most intensive and thorough schooling in the least possible time, so that they may take their college-acquired theoretical learning and their mill-acquired practical knowledge, and get into productive careers either in the sales force or in plant operations.

These men, where necessary, are moved from plant to plant; there is no single company mill that embodies all of the different processes and products, consequently the man must be trained in various mills until he has covered the ground.

Supervisory training courses are open to men in supervisory jobs who wish them, and experience is disclosing that most of the men who may be expected to make substantial progress are receiving this idea with enthusiasm. Supervisory training has made great strides in the past few years, but Carnegie-Illinois executives believe that when it is taken up by enough other industries to increase materially the aggregate experience with it, this type of personnel training will advance much further and more rapidly.

Miscellaneous training includes not only such training as that at Youngstown already mentioned, but contemplates considerable extensions. Introductory training on new jobs should cut the cost of breaking in new employees and is expected to decrease the accident rate even below where it now stands.

Job training to permit skilled workmen to advance in their ratings will carry an advantage to the company as well as to the men because it will assist in standardizing the crafts in the various plants at a high level of ability.

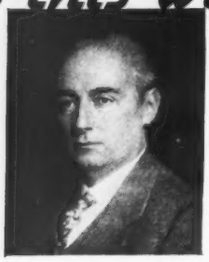
Night schooling, whether for English language and citizenship, or for more technical subjects, will obviously improve the level of personnel to the degree in which it is successful. Local school authorities are more than eager to go ahead with extending their facilities for adult education, since in most states where the company operates the states have qualified to meet the Federal grants in aid of adult education, and the local school body therefore receives a refund for approximately two-thirds of its night-class expense.

Enlightened Selfishness

The management of Carnegie-Illinois Steel Corporation sees this entire program not as something that is being undertaken for the obvious and immediate benefits of bettering the skills of the people, nor even for its obvious advantages to the company in building the morale of personnel and of home-town communities to higher levels. Rather is it considered of primary significance as an enterprise, actuated to be sure by enlightened selfishness, which will help to forward the progress of employee training in American industry.

As has already been said, the executives see the current movement as only the start of something that eventually will reach large proportions. And those who 25 years from now are still taking part in or watching the parade from the sidelines will, they are convinced, say, "It all seems so obvious. I wonder why in the world it was not done decades earlier."

It's this way in Washington



Harris & Ewing

CARTER FIELD

Washington Correspondent

Are the railroad labor negotiations in Chicago a straw in the wind pointing the direction labor relations will take in 1938? Some observers think so. At least, intelligent labor leaders have come to realize that they have an aroused public sentiment to deal with

ONE OF THE most encouraging developments for many a month, with respect to business in general and manufacturing in particular, has been the attitude of so substantial a group of union labor officials in the recent conference over raises and other things at Chicago.

For the first time since this country started to work out of the depression, organized labor, despite the knowledge that the Administration is with it on virtually every point, has shown a disposition to let the employer live and make a profit. This doesn't sound as though it were much of a concession. Some might think that of course labor would have to take this stand, because if there were no profits—if the employer did not "live"—there would be no jobs.

Live—and Make a Profit

Every employer who has had labor troubles, however, knows that it is simply impossible to exaggerate the importance of dealing with labor union representatives who agree frankly that the employer should not only "live," but should also make a profit. And it does not often happen that labor representatives have been willing seriously to discuss abandoning restrictions on their employers which they hoped to obtain by law.

A case in point in the railroad labor negotiations is the bill pending in Congress that restricts the length of any freight train to 70 cars. This measure, as everyone who understands railroading knows, is economically unsound. It tends to force more employment than is necessary —which, of course, is the reason the unions were for it. It also tends to congest terminals at times when it is vital to move perishable freight.

This bill actually passed the Senate. It passed the "greatest deliberative body in the world" after a very brief discussion. It was stopped temporarily in the House largely because, with the end of the session so near at hand, and with so many other issues of more importance to the general public on the calendar, it was difficult to put steam behind it.

Railroad representatives in Washington admitted privately that they had no hope of stopping this penalizing law in the next session, especially since no further action by the Senate would be required unless the House adopts amendments.

Thus it is plain that the willingness of so many labor representatives at the Chicago conference to call off passage of this law was not an empty gesture. They were giving up something they thought of real importance in order to permit the railroads to make enough money to give them an advance in wages.

It all sounds reasonable enough, but it was spectacular labor relations history, of truly tremendous importance to every employer and to every business man who hopes to keep on the job regardless of war, high water, and taxes.

Most observers here are inclined to think that this conference is a straw in the wind indicating the labor relations trend for the next year. This view may prove too optimistic. There is no sureness about it. But it seems probable for several reasons. One is that intelligent labor leaders realize they have a very much aroused public sentiment to deal with. There is more sentiment than they like for something they would fight to the last ditch to avoid—responsibility of labor unions for their actions, clinched on them by a law forcing their incorporation.

There is little doubt that Vice-President John Nance Garner and others who urged President Roosevelt to take a strong stand against sitdown strikes were correctly reading public opinion. They are expert in that particular job, and subsequent events have seemed to demonstrate their soundness.

An Ear to the Ground

Even the CIO seems to have softened on this point. John L. Lewis may seem intolerant of public opinion at times, but actually he has his ear to the ground all the while.

Another reason cited by those predicting a better era in labor relations is that the more intelligent leaders of labor are themselves perturbed about the obvious signs of the jitters in the stock market, and the evident anxiety of Administration officials about the general business outlook, despite the harping of government spokesmen on the favorable business indices.

So it just might happen that labor may decide to postpone the execution of the gold egg goose.

To Find Out What Employees Think

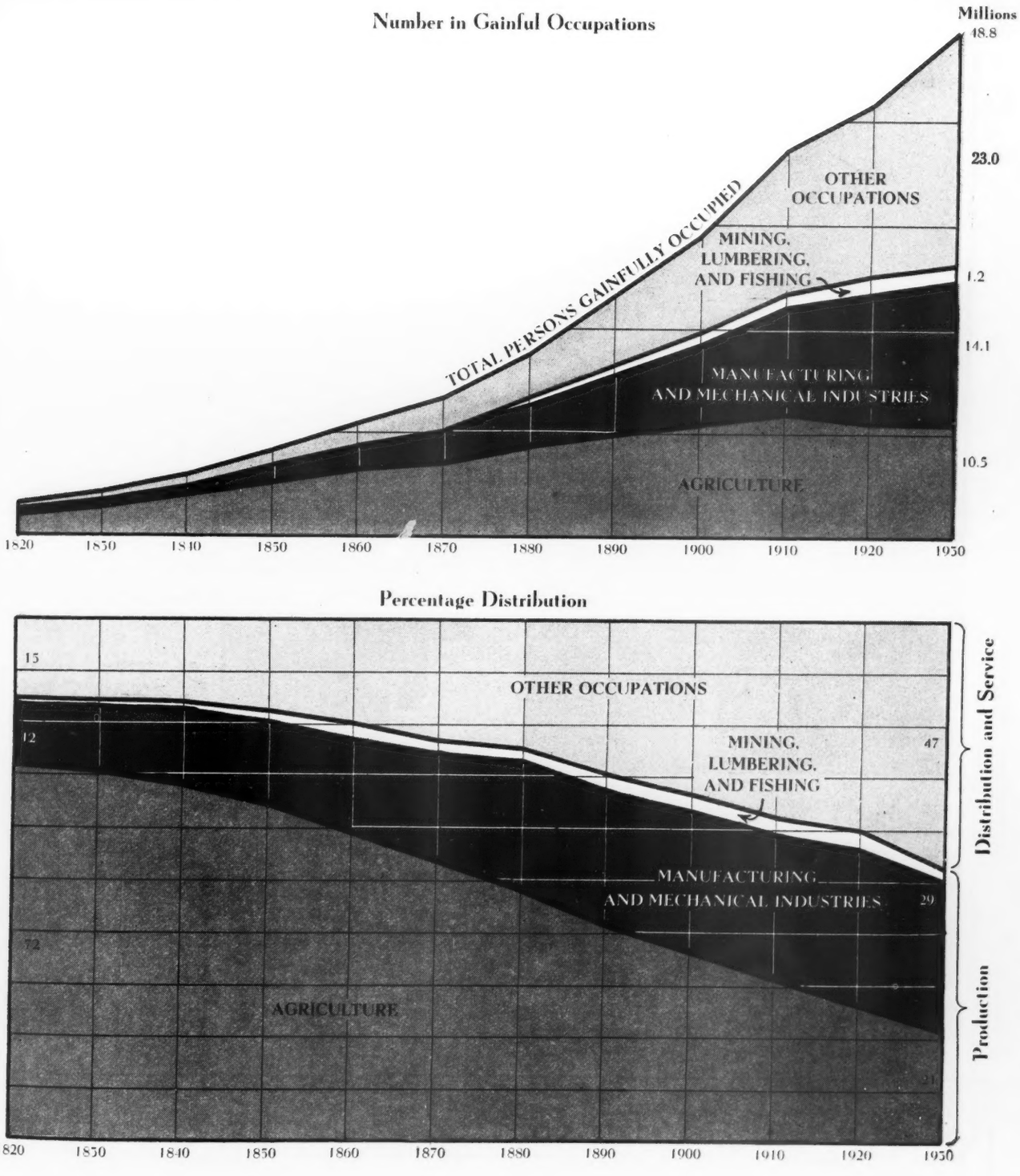
IF EMPLOYERS knew what employees think about them and the jobs they are doing, out of that knowledge might come a solid foundation upon which to build today's best labor relations policy. Good news, therefore, is a survey now being made by a research group under the direction of the National Association of Manufacturers.

For perhaps the first time in industrial history, employees all over the country will be asked what they think of their foremen, how they feel about their working conditions, what they like and do not like. They will vote on wage payment methods, vacations, sick benefits, dismissal procedures, and all the other things that personnel relations men debate whenever two or more of them get together in conference.

Obviously, the answers will provide management with an unparalelled opportunity to do the constructive job that its leaders have been urging it to attempt these many years.

Persons in Gainful Occupations

United States, 1820—1930



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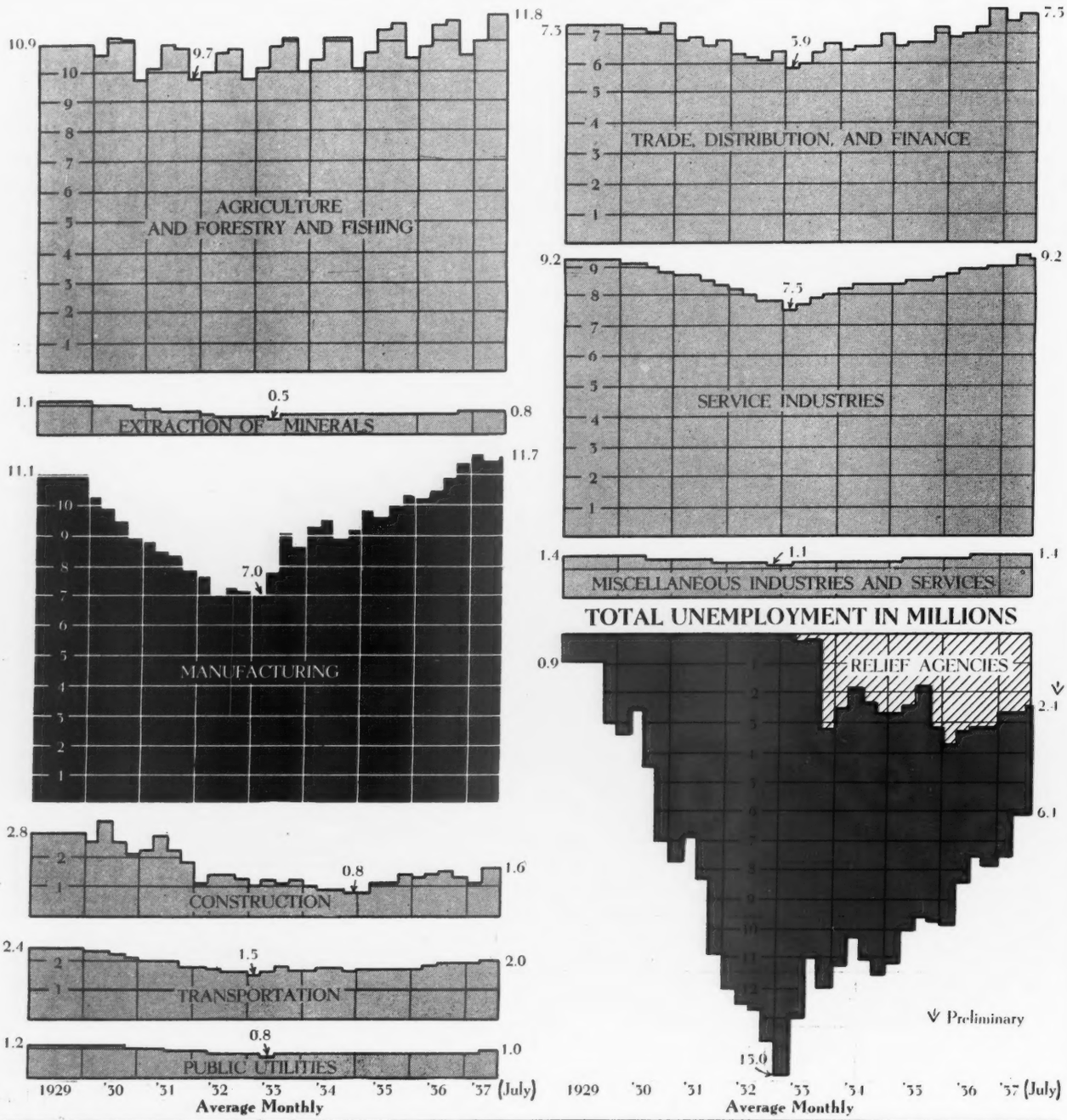
Employment and Unemployment

United States, 1929—1937

EMPLOYMENT BY GROUPS
IN MILLIONS



TOTAL UNEMPLOYMENT IN MILLIONS

The columns for 1929 show the monthly average for that year. Those for subsequent years represent the months of March, June, September, and December of each year.

In June, 1937, employment was higher than in 1929 in manufacturing, agriculture and forestry and fishing, trade, distribution, and finance, and service industries; lower in extraction of minerals, construction, transportation, and public utilities. Employment in manufacturing was 4.5 per cent above, and in construction 44.6 per cent below the 1929 monthly average.

The hatched portion of the unemployment chart represents the number employed by federal government relief agencies (CWA, CCC, WPA, etc.).

Sources: United States Bureau of the Census; other governmental and private agencies.

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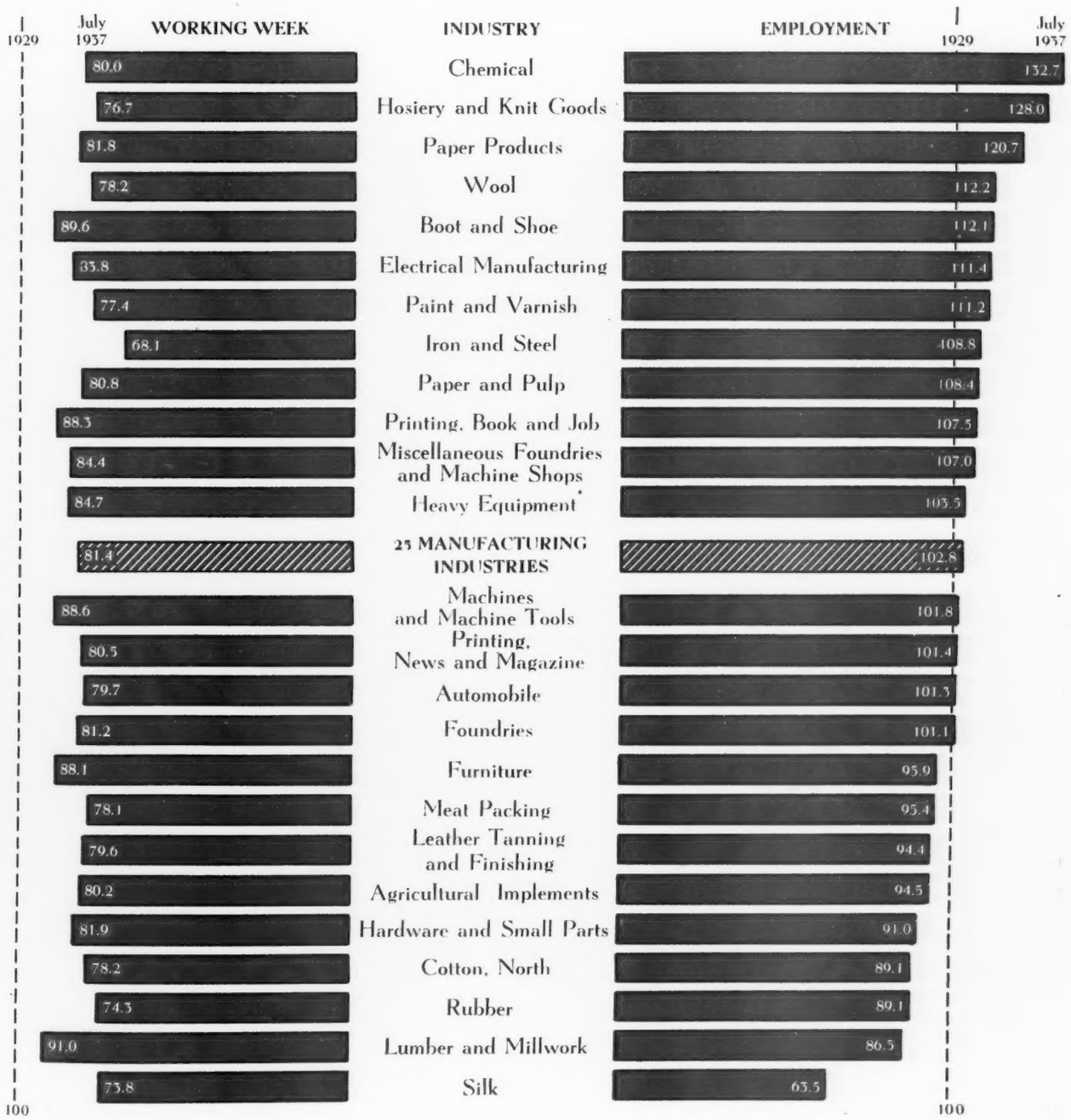
Working Week and Unemployment

25 Manufacturing Industries, 1929 and 1937

Index Numbers, 1929 = 100



"Manufacturing Industries" are the 25 industries included in the monthly inquiry of employment, hours, and earnings of the National Industrial Conference Board. Length of working week appears to have little bearing on volume of employment. The average working week is shorter, in comparison with 1929, in the group of industries where employment is below the 1929 level, than in the group in which employment is above 1929.

Source: National Industrial Conference Board.

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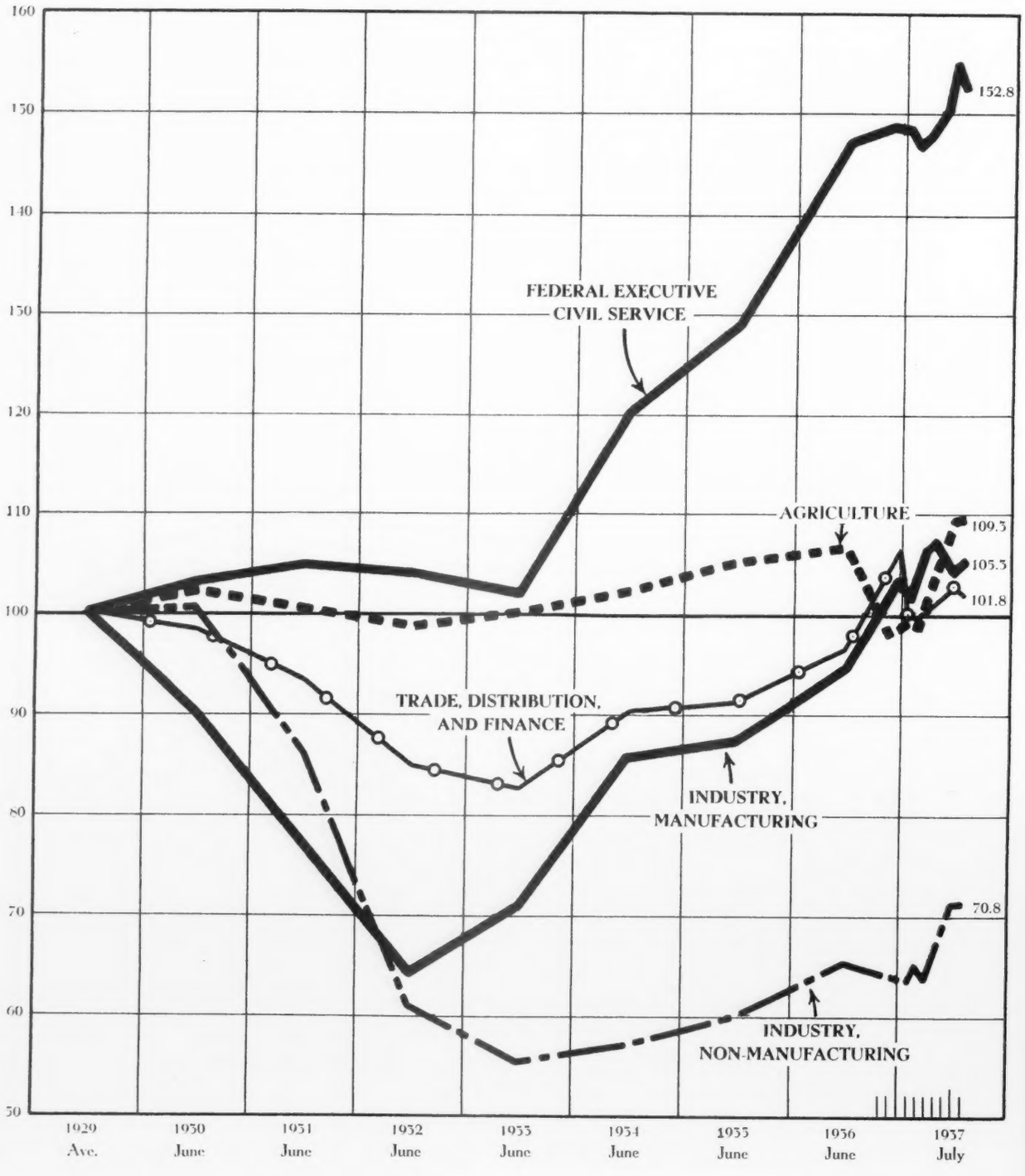
Employment, Major Subdivisions

United States, 1929—1937

Index Numbers, Average 1929=100



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How 133 Plants Look at Wage Incentives

Answering: Is the use of incentives decreasing? Should incentive systems be simplified? What is the union attitude? Do employees understand the systems? Should the incentive system recognize personal qualifications?

L. C. MORROW
Editor

MANY TIMES during the last three years I have been asked about wage incentives. Is their use increasing or decreasing? What types are most used? How do unions feel about them? How extensive is the application of straight daywork — measured daywork—straight piecework?

My answers were based on information gained from asking the same questions of individual manufacturers. They were correct as to specific cases but they didn't necessarily give the average condition that exists today.

So I conducted a survey. One hundred and thirty-three plants cooperated. These plants represent pretty much all types of manufacture, as can be gathered by reading a list of their products—not a list complete to the last gadget, but mentioning approximately all the types of product:

Shoes
Instruments
Rubber products
Surgical supplies
Household machines and equipment
Paper and paper products
Electrical supplies
Electrical equipment
Refinery products
Hardware
Hand tools
Hosiery
Building insulation
Bearings
Chemicals
Clocks
Steel
Steel products
Materials handling equipment
Printing and bindery equipment
Refrigerating machinery
Small metal products
Photographic supplies and equipment
Textiles
Textile products
Air - conditioning equipment
Heavy machinery
Drugs
Alloys
Toiletries
Mining equipment
Rope and twine products
Automatic machinery
Plastics
Stampings
Printed products
Office machines
Agricultural equipment
Furniture
Printing equipment
Cutlery
Food products
Machine tools
Aluminum products
Automobile parts
Meat products
Cement
Foundry products
Railroad equipment

The accompanying tables tell the statistical story. Approximations are something like this:

46 per cent of the 133 plants are paying 47 per cent of their employees on a straight piecework basis.

46 per cent are paying 46 per cent of their employees on the individual-bonus basis.

35 per cent are paying 29 per cent of their employees on the group-bonus basis.

7 per cent are using measured daywork to determine the earnings of 52 per cent of their employees.

86 per cent are paying 45 per

What Incentive System Are You Using?

133 Plants

Incentive System	*% of Plants Using to Some Extent*	*Average % of Employees Being Paid by This Method*	*Range in Actual %*
Straight Piecework	45.86	47.40	½ to 100
Individual Bonus	45.86	46.30	½ to 100
Group Bonus	34.60	28.66	1 to 100
Measured Daywork	6.80	52.33	2 to 100
Straight Daywork	86.47	45.11	3 to 100

Is Your Use of Incentive Payment Increasing, Decreasing, or Stationary?

124 Plants

Increasing	%	*Decreasing*	%	*Stationary*	%
65	52.42	4	3.23	55	44.35

cent of their employees on a straight daywork basis.

52 per cent of the 124 plants now using incentive payment systems are *increasing* their use; 3 per cent are *decreasing* their use; and 44 per cent are neither increasing nor decreasing their use.

32 per cent of the 103 plants which have reached conclusions one way or the other say they believe their present incentive systems should be simplified; 68 per cent say that present systems are simple enough.

32 per cent of the 128 plants which report that they have or have not discussed wage incentives with unions say they have; 68 per cent say they have not.

10 per cent of the 116 plants reporting on measured daywork say they are considering its adoption; 90 per cent say they are not.

44 per cent of the 120 plants willing to take a stand say they believe an incentive system should recognize personal qualifications such as dependability, versatility, and length of service; 56 per cent say they believe it should not.

Should Systems Be Simplified?

The cooperating plants were asked to tell why they believe their present incentive systems should or should not be simplified. On the part of those advocating simplification there were a fair number of scattered reasons but a heavy majority said, in effect, "For better understanding of and computation by employees."

For not advocating simplification, the reason most frequently advanced was: "We use straight piecework, and that is the simplest system." Other reasons included: "Simplification implies compromising with accuracy"; "system successful for over 10 (or 16, or 25) years"; "simpler system would not adequately measure our complicated operations"; "it is liked by majority of workers and is supported by the union."

How Unions Look at Incentives

Another question asked in the survey was, "What has been the union attitude toward wage incentive systems?" On account of the prevailing interest in this question I think it well to quote verbatim a considerable number of the replies:

Not very understanding.

* * *

No objection, as yet, to present system.

* * *

Indicated straight time or daywork preferable.

* * *

Would rather see all incentive systems abolished.

* * *

Receptive.

* * *

Retain bonuses as they were in effect before the signing of the contract.

* * *

Indicated clearly that they were not interested in any form of premium system, vacations with pay, bonuses, etc. They were interested only in hours of work and hourly rates of pay.

* * *

The union has no objection to the incentive system. In fact, the employee members prefer the incentive.

* * *

Co-operative.

* * *

Entire approval except for occasional questioning of individual piece rates.

* * *

Critical. Union criticism of incentives is apparently used chiefly to agitate dissatisfaction. They seem willing to accept incentives in bargaining negotiations.

* * *

Just beginning negotiations with CIO. The subject of incentive has not been broached but appears not to be a point of controversy at present.

* * *

Advocates lifting of limits.

* * *

Employees agreed to let incentives stay in (average earnings over day-rate will be at least 10 per cent).

* * *

Union attitude understood to be opposed to incentives. Our employees desire to retain their incentive plan.

* * *

No objection on part of union.

* * *

No change in attitude since preunion period.

* * *

Prior to signing of agreement we used an individual bonus system. This was eliminated and all factory employees were placed on daywork at the time agreement with CIO was signed.

* * *

Not favorable.

* * *

In both directions—straight daywork and an incentive. Radicals want work and pay with no measurements.

* * *

So far, acceptable to our policy of guaranteeing 20 per cent above base rates for honest, efficient work.

* * *

Entirely satisfactory. Practically no grievances connected with incentive system.

* * *

Opposed to incentive plans. This was our experience in discussing it with the representative of a union that we have not as yet recognized.

Union attitude has been that our incentives are just.

* * *

From my personal experience with one union, would say that it would propose or denounce either system (day or piece) if it furthered or hindered its cause.

* * *

Entirely against anything that might develop company loyalty against personal gain due to aggression.

* * *

Okay.

* * *

Only minor complaints.

* * *

Four years ago we had a task and bonus system and the union asked for straight piecework.

* * *

Cooperative—want workers to increase earnings by greater efficiency.

* * *

In opposition.

* * *

We deal with two A.F.L. unions on this and other questions. Their attitude has been a fair one.

* * *

Accepted—piece prices.

* * *

As a whole, they are satisfied with straight piecework.

* * *

Our dealings have been with an independent union. They are satisfied with piecework, but they want it expanded to include more.

They have desired to participate in the approval of standards and piece prices.

* * *

Union has not offered any opposition to incentive plan now in force.

* * *

No objection to their use.

* * *

No serious trouble.

* * *

They have not raised the question.

* * *

Acquiescence.

* * *

We understand that local union has in mind suggesting day rate payment in place of present incentive plans, but this has not officially been submitted to us.

* * *

They state they are against incentives but have no answer when we ask for a guaranty of a fair day's effort, therefore no interference.

* * *

They asked that all incentive work be on a straight piecework basis.

* * *

Has in general been favorably disposed to those incentive plans on which their members are now working and with which they are now familiar.

* * *

The same as usual, reaching out for something which they didn't have and trying to induce us to pay their men on a straight daywork rather than an incentive basis. We still continue our incentive system.

* * *

All piecework rates approved by the union.

Opinions on Measured Daywork

Measured daywork, also, was considered. The question was asked, "What advantages do you see in measured daywork?" Again, on account of the present-day intense interest in this method of incentive payment, it seems advisable to quote many of the replies:

A better relationship when and if the plant is unionized.

* * *

None—a bonus figured out weekly or for the average of several weeks will achieve the same purpose with the possibility of more frequent control.

* * *

Computing the hourly rate under measured daywork leads to excellent cooperative relationships with employees. Our management feels that it is more practicable in applications where production quantities are somewhat larger than ours, thus making it possible to keep operators on one class of work. Our operators here may perform three or four classes of work even in one

(*Continued on page* 172)

Should Your Present Incentive Systems Be Simplified?

103 Plants

Yes	*%*	*No*	*%*
33	32.04	70	67.96

Have You Discussed Incentive Systems with Labor Unions?

128 Plants

Yes	*%*	*No*	*%*
41	32.03	87	67.97

Are You Considering the Adoption of Measured Daywork?

116 Plants

Yes	*%*	*No*	*%*
12	10.34	104	89.66

Should the Incentive System Recognize Personal Qualifications?

120 Plants

Yes	*%*	*No*	*%*
53	44.17	67	55.83

Good Inspectors Are More Than Rejectors

Negative inspection—the usual kind—is nothing more than the flagging of defects. The positive inspector goes way beyond that, finds out why, sees that it doesn't happen again—and saves his company money

H. P. LUSCOMB
Switchgear Works Department
Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

NOT SO LONG AGO, all inspectors were looked upon as policemen who flagged defective work on materials, identified defective or rejected apparatus or parts with a specified tag or mark, then proceeded to a new job. This is the accepted activity of the inspector—a negative activity of rejecting defective materials and workmanship. For the protection of the customer and the manufacturer's market this inspection is fundamental.

That the inspector's function can and should be *positive* as well as negative is not so generally accepted. As his function becomes positive the inspector reduces defective work and material losses. As he becomes positive in his relationship to manufacturing he becomes a more important factor in the whole productive process.

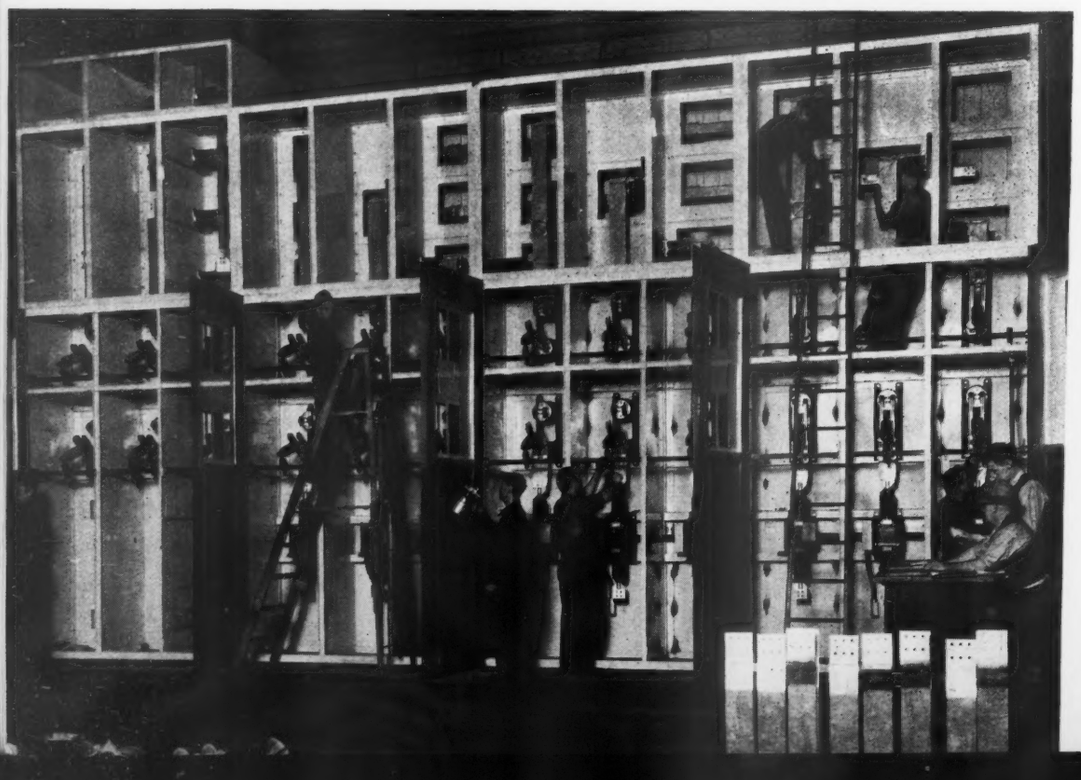
They're Not Responsible

Negative inspection is the searching out of defects in workmanship or materials, separating the bad from the good with no responsibility on the part of the inspector for the control of defective work. The more defective workmanship and defective material found, the more valuable is the inspector to the employer. Negative inspectors ordinarily are not called upon to use their own judgment.

With negative inspection the work of quality control rests entirely on the supervisor in charge or his assistants. The personnel for negative inspection is not difficult to obtain. Workmen with a knowledge of processes or sufficient skill to check a job to determine its correctness can be selected as inspectors. On simple operations or parts, almost anyone with a grade-school education, who can think fast, and has good eyesight, can be made into a negative inspector.

Positive inspection, on the other hand, is not only the searching out of defects, but when the defect is found, the job has just started for the inspector. The positive inspector assumes responsibility for defective work and material, and justifies his existence by the savings made in reducing defective work or material losses to a minimum. His or her real value can be accurately determined by the action taken or work done after finding the defect. By supplementing the "negative" inspectors with trained "positive" inspectors, defective workmanship and material losses will be minimized, and the total number of inspectors can be reduced.

After finding a defect in work-



Positive inspection. The construction of metal-clad switching equipment is a typical job on which the inspector's responsibility does not terminate with the finding of defective workmanship or materials. His function is positive and plays an important part in controlling quality as the job progresses as well as when it is completed. The inspector is seated at the portable table

manship. the positive inspector proceeds to analyze the job. Was the defect due to improper tooling? To carelessness or insufficient instructions? Should the worker be penalized? Would the same defect be likely to happen again? What must be done to prevent a recurrence? When the cause has been determined, the positive inspector notifies the supervisor who is responsible and insists that the necessary action be taken to eliminate the reason for the defect.

Should the defect be one of material, the analysis should not only determine whether the quality of the particular piece of material is up to the standard specifications under which it was made or purchased, but also whether or not the application of the material is correct. Does the material require special tools or processing? What substitution could be made? The inspector cannot be expected to know all the answers, but he can call the facts to the attention of those in the organization who do.

Must Have the Right Tools

For instance, if castings are defective, the foundry is promptly notified so that a check can be made as to possible changes in molding such as pattern changes or location of risers, chills, and gates. Should the defect involve sheet metal or drawn copper, a study can be made to determine whether the material is too hard or too soft for the manufacturing processes to which it is subjected. Should the defect involve materials purchased from an outside supplier, the purchase specifications are referred to, and the material is carefully checked and rejected if it fails to meet the requirements.

In order that the positive inspector will have the time to analyze the defect and make corrections, he should be equipped with necessary tools and gages and complete information as to requirements, so that the time required to inspect the apparatus or part will be held to a minimum.

Positive inspection is most valuable where standards depend to some extent upon the judgment of the inspector. Under these conditions it is quite difficult for the inspector to be consistent. As consistency is essential, the inspector should have a clear knowledge of the function and application of the apparatus or part. He should be familiar with human as well as machine-tool limitations.

The positive inspector is production minded and realizes that, in order to meet shipping dates and maintain schedules, any unnecessary delaying of work must be avoided. Quite often an inspector's indecision has caused the failure of jobs to be shipped on schedule.

He is also cost minded. Requiring unnecessary refinements on parts or finished apparatus is costly and can only be avoided by a clear understanding of the applications and functions of the apparatus. This understanding can be obtained by having inspectors' meetings and inviting the design engineers or salesmen to give talks on what is expected in the way of quality, or by selecting supervisors of inspection who have the qualifications necessary to decide what is considered a correct standard of quality.

The inspector must be familiar with the method of accounting as it pertains to payroll control. He should have an understanding of the mechanics of the incentive system, if one is used, and how any inconsistency on his part may make it impossible to establish a fair time allowance or piece price.

Special Training Needed

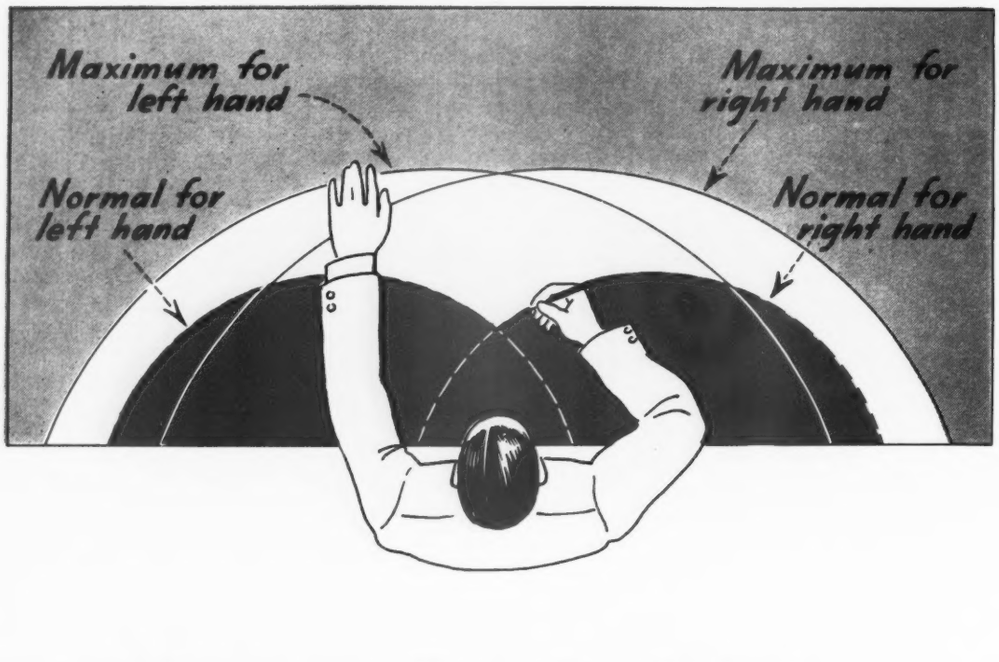
Raw material inspection involves inspection of castings, manufacture of steel, plating and polishing of parts, manufacture of insulation materials, insulating of wire, forming coils, and other raw materials used in machining or assembly. This type requires an inspector with special knowledge and training in the manufacturing of the raw materials and the purchase specifications of bought materials.

The positive raw material inspector not only familiarizes himself with the specifications under which the material is made or purchased, but also analyzes the application of the material as to what is considered a commercial standard regardless of the wording of the specification, since it is difficult to word specifications in such a way that two inspectors will interpret the finish requirements alike. Quite often increased costs result from insistence on a finish or surface quality above what is ordinarily considered a commercial standard.

Inadequate or faulty raw material inspection can prove expensive if defective material is allowed to pass through to an assembly department, for the failure of a small part can create costly repairs.

(Continued on page 168)

Negative inspection. On the left are three girl inspectors who inspect molded plastic parts for finish, cracks, and, in some cases, dimension. They also count the number of pieces. Their efficiency is determined by the amount of defective pieces found. But they play no part in controlling the quality of work. That responsibility devolves upon the supervisor of the department or his assistants



Motion Study Makes Safe Plants Safer

Right way is safe way. Safe way is right way. Motions should be confined to the normal work area. And that's all the motion study man is looking for

WILLIAM R. MULLEE
Standards Department
American Hard Rubber Company
Butler, N. J.

SOME PEOPLE still think of motion study as a thinly disguised method of speeding up production. They naturally conclude that the motion-economized plant is not the safest one to work in.

How wrong they are. Motion economy and the speed-up are quite unrelated. And the facts show that the "one-best" way is necessarily the safest way.

Let's see why. Let's take the principles of motion economy one by one and see how closely and universally they are linked with safety.

Holding and Useless Motions

Not only is holding poor motion practice, but it is also extremely poor safety practice. To both motion study and safety man, the hand is the poorest holding device.

For example, a drill press operator holds the piece fast to the table with the left hand and brings down the drill with the right hand. Halfway through, the drill binds and whirls the metal piece around, causing a nasty finger injury. Good motion practice prescribes a fixed jig or vise to clamp the work. The jig not only frees the left hand to move pieces but also insures safety.

In many cases it is possible to feed two jigs, one with each hand, using some form of hold-down to keep the pieces in place in the jig during the drilling operation. Labor savings are often 30 per cent—and the job is safer.

A motion study of a certain operation on a grinding lathe showed that 10 per cent of the time was lost extracting the piece from the chuck. A glance at the operator's hands showed where knuckles met grinding wheel while unchucking. A mechanical hand was attached; the job was safer and 10 per cent faster.

Needless motions are of great importance to the safety man. Introduce unnecessary motions and you invite trouble. Safety guards, for instance, are installed with the fond hope of eliminating accidents. Some time later a check-up shows that some of these guards have been taken off or rendered inoperative.

Now what is the reason for this condition? Check up and you will usually find the guards that remain on the job are those that do not interfere with the operator's motion path. The operator removes guards that cause needless, ill-directed, and ineffective motions.

In one plant a number of operators buffed large hard rubber sheets between double buffs. The operator held the sheets at one end in a horizontal position and worked them in and out of the buffs. To prevent injuries, the management provided safety belts, which buckled around the waist and were chained to a pillar behind the operator. This arrangement promised to confine in-

juries to hand abrasions rather than body injuries.

Several times during the day the operators unbuckled the belts to shift piles of work or to talk to inspectors, attend to personal needs, etc. If they had a small lot of work, buckling and unbuckling the safety straps looked like needless motions, particularly if the foreman was not looking. They became careless. One day, a sticky buff took hold of a rubber sheet and pulled in the operator's hand.

Later a motion-minded operator suggested a fixed guard in the form of a pair of rollers mounted in front of the buff. This required no "Get Ready" or "Clean Up" like putting on or taking off the safety belt. The operator was no longer chained to his job and everybody was happy.

Study the Motion Path

One day the safety man went upstairs to take a picture of the new buff guard. To his great surprise it was missing. Questioning brought out the fact that it interfered with the motion path.

It was evident that one management error was overcome only to blunder into another. A motion picture was taken of the operator's movements while using the buff, and it showed that the guard interfered on the down stroke. Experiments were made by opening up the rollers to overcome this condition until a point was reached at which the rollers did not interfere with the operator's motion path but still kept his hands out of the buffs.

No Reaching

Motions should be confined to the normal work area for greatest production with minimum fatigue. This means less danger of entangling fingers in belts, gears, etc. They are usually outside normal work area.

When dangerous conditions exist within the normal work area, one remedy is to move the area away from the source of danger. For example, many accidents occur on machines like leather embossing presses. The press helper is usually charged with straightening out the leather, but sometimes he places too much confidence in the embosser and anticipates his stopping the press.

The only effective way to tell the embosser's helper to use a stick is to put a wide table on the helper's side of the press so that he cannot reach in and do his work effectively by hand. In other words, you locate the dangerous situation beyond the normal work area.

Save the Get Ready

We frequently advise grinding operators: "Wear goggles and protect your eyes." A few days later we walk through the grinding department and find that the operator has hidden away the goggles to avoid the nuisance of putting them on and taking them off. Then something flies off the grinding wheel and he is all ready for the hospital.

Motion study engineers would call putting on the goggles a *get ready* and taking them off a *clean up.* Common sense would suggest fixed guards like a safety glass plate fastened to the machine requiring neither a *get ready* nor a *clean up.* Such guards really work. Our safety man has an interesting exhibit on his desk. It is a safety glass plate with a thin abrasive wheel driven halfway through by centrifugal force. One look at it is better than a thousand words.

Gravity Feed

When a motion analysis of a job shows a long *transport* element to bring the piece to the point of use, the engineer recommends gravity feed hoppers with dilevery chutes. By shortening or eliminating the *transport* element, a worth-while labor saving is accomplished.

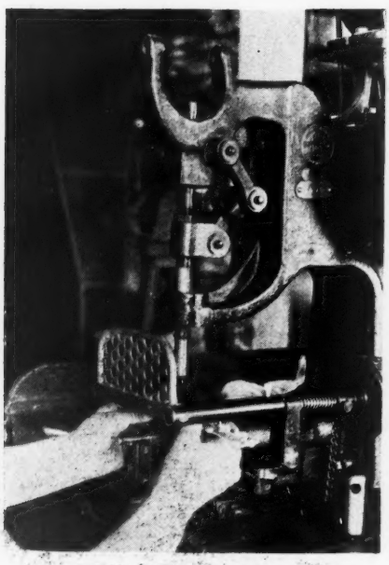
Why Not Ejectors?

To eliminate the grasp and transport elements involved in removing a finished piece from a die or holding fixture, the motion study engineer tries to provide ejectors. These ejectors may be foot operated or machine operated. Jigs and fixtures are often tapped for air ejection. At one plant all punching of hard rubber pieces from sheet has been changed to hollow dies, whereby the pieces are ejected through the top of the die. This not only saves a few motions but also keeps the operator's fingers out of the die.

Drop Deliveries

The motion study engineer frequently talks about a "drop delivery." This means to release the piece at point of use instead of carrying it aside to a tote box. Labor savings of 5 to 10 per cent are common. Safety is improved because the eyes do not leave the workplace. One hand is sometimes injured while the eyes follow the other to the tote box.

Again, 25.9 per cent of all accidents are due to handling, and drop delivery eliminates handling. A chute in one plant was provided to carry used molds down two floors to the melting pots, saving much handling. Lift truck skids are drop delivered to the floor level, saving the necessity of rehandling.



Conventional guard on stapling machine. Not 100 per cent safe because it obstructs the operator's finger movements. Some fine day the operator will get disgusted with this safety guard and take it off

Same machine, but a much better guard and a safer job. Guard is made of celluloid. Motion study of operation shows that it does not obstruct the operator's motion path. Production increased 15 per cent

Power Trucks in Tight Places

Long-distance hand trucking survives in many a plant because "our aisles are so narrow." Well, this one has narrow aisles, yet it operates tractor-trailer trains without trouble and with profit. Here's how

H. J. BERMAN
Planning Department Manager
Edison General Electric Appliance Company, Chicago

WHEN THIS BUSINESS was smaller, materials were transferred from one department to another by hand truckers. The truckers made fairly long hauls and always came back to their individual departments with their trucks empty—plainly a costly practice.

To be sure, we had mechanical handling installations at strategic points, but our plant had been laid out for hand trucking, and on hand trucking it got along until production reached a volume that cluttered up the aisles and tied plant transportation in knots.

There were, on analysis, long stretches where the work could be performed admirably by electric lift trucks. Other stretches seemed, with one important exception, made to order for a tractor-trailer train.

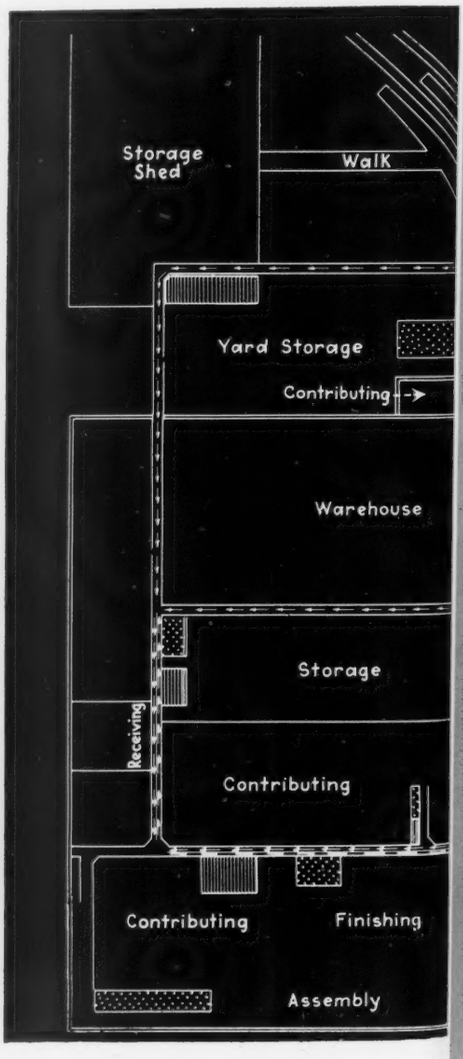
The exception is one that exists in many factories. The aisles are so narrow it would be impossible to load and unload the trailers except by having the tractor operator climb down, tug the trailer into place, and then resume trucking. Obviously this would so dilute the effectiveness of power handling that it would eat up the bulk of the profit of the installation.

It became our task to devise some method of picking up and delivering trailer loads in aisles too narrow for conventional methods; we could not conceivably widen aisles enough to fit any known technique. Eventually, the problem was worked out by collaboration between an equipment manufacturer and our own engineers. Together we devised a teamwork of standard Yale lift trucks, with slight alterations, and of trailers quite different from anything known to any of us.

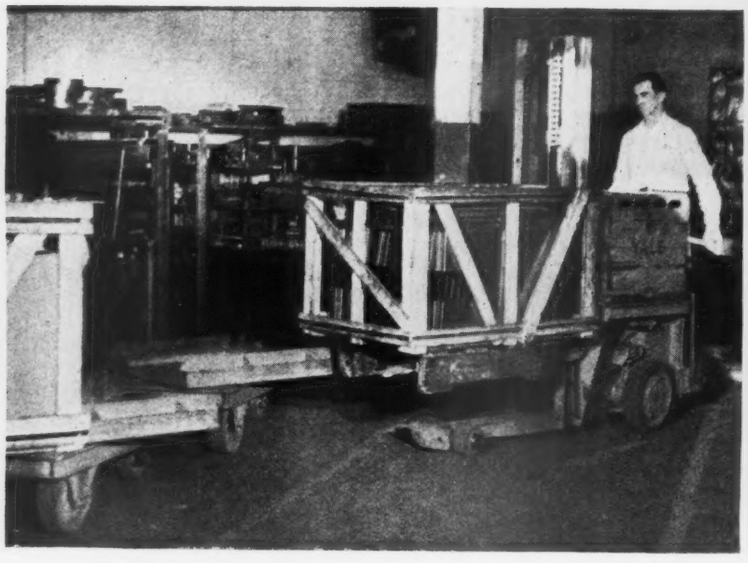
Can Load in 10-Ft. Aisles

With this special equipment we can handle loads approximately 3 ft. wide and 4 ft. long in even our narrowest 5-ft. aisles, and with 10-ft. loading and unloading zones, perform operations that would normally require a width of 18 ft. There is nothing about this new method that would not just as well fit any other plant.

Before explaining the details of this special equipment it seems advisable to look at the over-all solution of the handling problem. Shown here is a schematic plan of operation. There are two large buildings at the east, another building at the west, between them a spur track and switchtracks.



These trailers have specially designed swivel tops that swing automatically into loading or unloading position



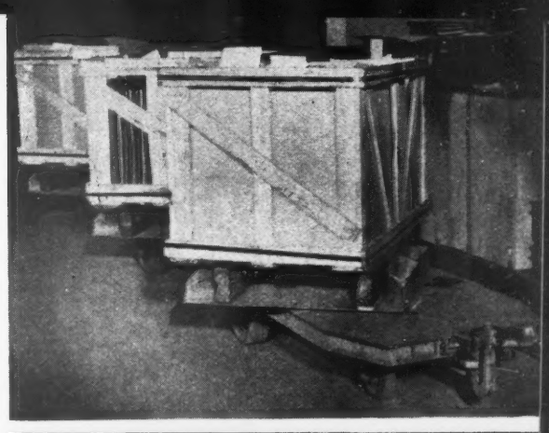
The bulk of the actual manufacturing operations are carried on in the main east section. At the west most of the functions are supplementary, such as storage, packing, and some assembly. The west building therefore seems logically to be one separate unit of the handling system, with the main part of the task remaining in the east or main buildings.

In the main buildings the largest operation is electric range assembly. To this department come all parts and subassemblies. On analysis, the main buildings resolved into two major transportation systems. One of these would serve punch press, sheet metal, and vitreous enamel departments and some stockrooms, and touch range assembly along one side.

The second, which would have the most diversified and the heaviest loads, would serve range assembly on the perimeter of this large department, bringing parts from stockrooms and other departments. If this seems a rather simple transportation problem, please keep in mind that for ease of understanding, we have simplified the description down to the essentials, and have ignored the less prominent departments and operating sections.

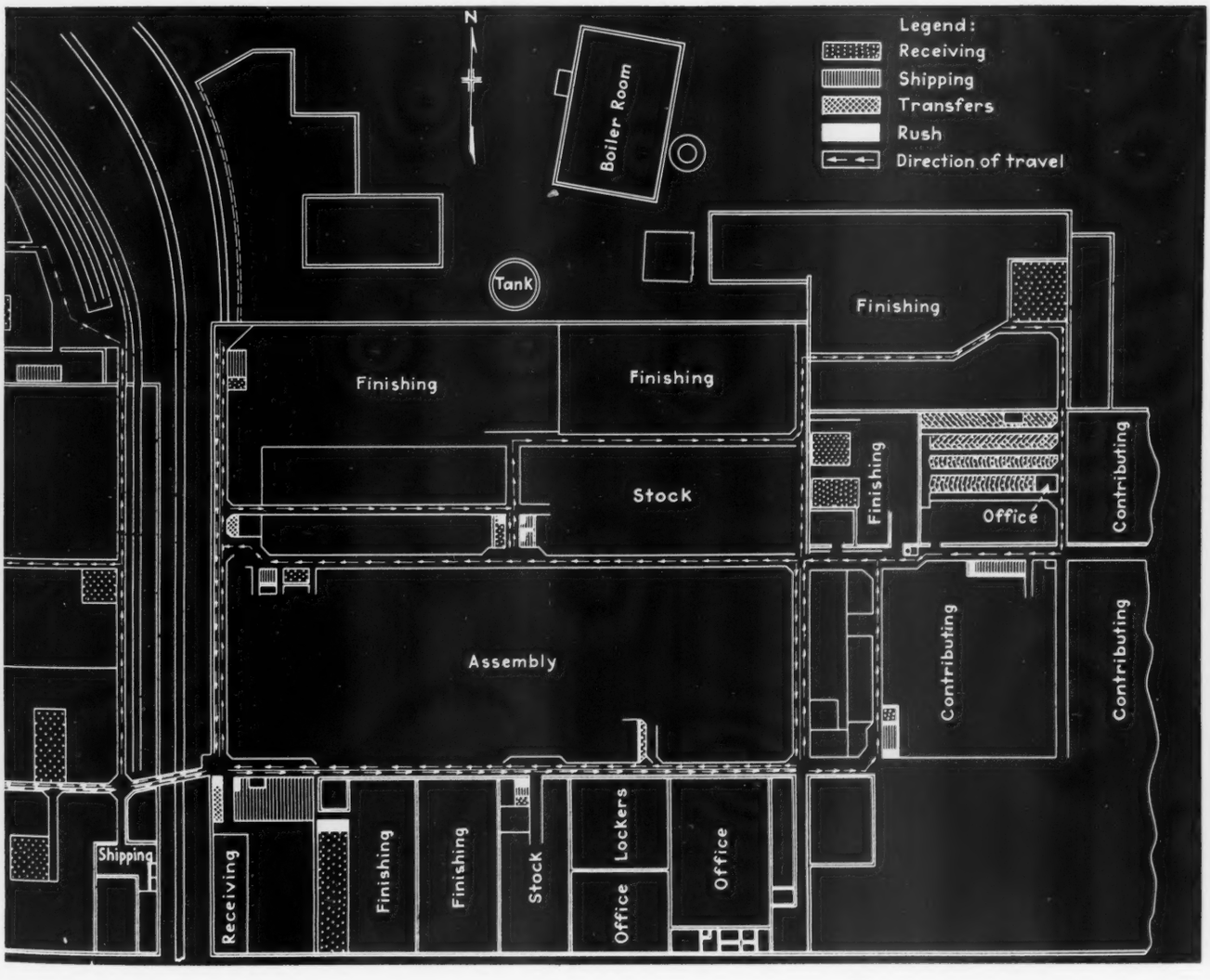
So far, then, we have a single system for the west building, and two systems for the main buildings. Our fourth system ties the two buildings together. This gives us three plant routes with a fourth that is very much like a transfer

(*Continued on page 158*)



Three trailers make a train. These three have just been loaded

Here the high-lift truck has hooked on, and the trailer tops have automatically swiveled back into traveling position



. . . make their contacts with industry mostly through the personnel department

Social Service and Industry

JOHN RICHELSEN
Personnel Director
Vanadium Corporation of America
Niagara Falls, N. Y.

INDUSTRY has come a long way in recognizing the profit of certain social service ideals. Don't miss the word "profit" in the preceding sentence. Much of the program of social service has been voluntarily adopted by industry; some of it has been accepted because of legislative compulsion.

Many things proposed by social service planners have been fought, step by step, only to have industry finally realize that the changes advocated were not only of humanitarian value but also profitable.

On the other hand, many things proposed by social service must be resisted by industry to the last ditch. And the personnel director has to do much of the resisting because social service agencies make contacts with industry through him.

Calls Up About a Job

A social service agency calls up and wants a job for an 18-year-old boy on the grounds that he will surely become a criminal if he is not speedily put to work.

Another agency urges employment on the basis that the applicant has a large family in needy circumstances.

If the personnel director inquires politely about the previous employment history, state of health, age, and other essential qualifications of the prospective employee, he detects amazement in the voice of the social worker that such considerations should be given precedence over the fact of dire human need. And positive resentment is noted if the personnel director is honest enough to say that the last thing he cares about is whether the applicant is in distress or not, and that he checks the fact of his need against, not for, the social worker's candidate.

Hard-boiled? Not at all. Industry is interested in social service only on the basis of what it pays industry in dollars and cents.

The object of industry is profits —profits as wages for work, and profits as wages for capital. When industry cannot make profits, it goes out of existence.

Industry is a war for profits against unnecessary expense, a constant conflict against costs and waste. Nevertheless, industry has come a long way in recognizing the profit of many social service ideals. And industry needs the continued prodding of humanitarian forces.

Any personnel director will welcome information about prospective employees who have the qualifications for becoming profitable helpers in his industry. He will welcome information and ideas that will increase the efficiency as well as the happiness of the existing group of employees. But he resents the implication of social service that business, as business, should wet-nurse charity to its own destruction.

Industry Often Shortsighted

Industry has by no means been guiltless in its resistance to programs aimed to ameliorate the workingman's condition. In its pursuit of unreasonable profits to capital, industry has often failed to be openminded even to its own best interests. Industry has frequently been proved shortsighted in a stubborn fatuity that what is good for the worker must necessarily be bad for the employer.

Now let social service make an equally frank confession of its sins and shortcomings and follies, and then the peacemaking personnel director may pronounce the two forces joined in wedlock. What common sense has then joined together, let no zealot put asunder.

How Well Is Your Plant Run?

U. L. HARMON
Vice-President
Dryden Rubber Company, Chicago

4. Sales Policies

STATIC

Company A is one in which selling effort is unorganized and misdirected. Some of the salesmen are on salary, others on commission. Some of the commission men devote their time to six or eight totally unrelated items. The so-called sales manager occupies his time principally with clerical work, such as reading and sorting the mail, checking and pricing orders. He leaves the supervision of the sales force pretty much to the salesmen themselves. Salesmen become mere order takers and follow-up men.

There is no sales policy. Knowledge of market conditions is confined to a limited personal contact with the customers or to conditions as reported by the salesmen.

There is no territorial division of the salesmen. There is no analysis of sales, no sales budget. There are no quotas.

Selling prices are either low as regards competitive conditions or competitive without regard to overall effects on profit and loss. Since prices are based on unproved costs, the sales department must wait until an accounting period eventually arrives to see if an actual profit was made.

Advertising is spasmodic, poorly planned, poorly executed. Sales promotion is unheard of. New business is the result of luck rather than of a planned program.

SEMI-PROGRESSIVE

In this semi-progressive organization, as in Company A, knowledge of the market is limited. It is not based on research, analysis, and personal contact, but is confined to an extremely limited personal contact with the customers or to what the salesmen have to say.

Company B sells its products on a hit-or-miss basis. It budgets sales, to be sure. But the sales are not classified by lines of products or types of customers.

Allocation of sales territories in Company B is inequitable. It is not established on a profit basis.

Analysis of gross and net profit by salesmen, customers, and products is not attempted.

Although the sales management is aggressive, centering around the managing head, with the salesmen closely supervised, the sales, advertising, and promotion programs are not coordinated for best results.

The price structure is rigid. Profitable business is often lost to competition because of faulty cost determination.

As a whole, the sales end of Company B is probably its best division. The selling effort is not directed in accordance with the best profit possibilities, but volume items and volume productions are principally sought in the hope that volume will reduce overhead sufficiently to increase the profit.

MODERN

The sales manager of Company C, on the other hand, has a complete knowledge of the market, based on research, analysis, and personal contact. He knows where the customers are, what articles they buy. If they do not buy from him, he knows why and can change his tactics accordingly.

Company C has a sales budget, classified by products and customers, equitably allocated to salesmen and territories.

Factory follow-up work is left to an order department which is constantly in touch with the factory and can immediately flag irregularities and notify the selling department—which in turn can advise the customer what to expect. Thus the sales force is always sure of being one jump ahead of the customer.

Sales promotion and advertising programs are well coordinated. Sound pricing, as it should be, is based on standard costs.

Finally there is a determination of profit and loss by salesmen, by territories, and by customers according to product classifications. This gives the sales manager the final picture he is looking for. He is able to establish selective selling with all the selling effort directed in accordance with maximum profit possibilities as regards territories, customers, and products. There is no guesswork on his part.

5. Production Policies

STATIC

In Company A, as previously mentioned, the organization is of the one-man type. This weakness is very apparent in the production management. Delegation of responsibilities is widely spread, often overlapping and confusing.

For this reason the departmental supervision is often weak and ineffective. The floor supervisors are

SEMI-PROGRESSIVE

Some semblance of distribution of duties is found in Company B, the semi-progressive organization. For instance, there is a production head with several assistants and foremen. However, they try to do the thinking for the floor supervisors, and although it is quite true that responsibility is not delegated quite so haphazardly as in Company A, there

MODERN

In Company C one finds the plant organization charted with production superintendent, chief chemist, development engineer, and time-study engineer on approximately equal footing.

The chief chemist is responsible for formulas, and for the testing of raw materials and finished goods.

The development engineer is re-

5. Production Policies *(continued)*

STATIC

held responsible for planning and scheduling their own production, and for ordering their own stock. As a natural result, this leads to carrying large work-in-process inventories so that they will not be criticized for not having the material with which to fill their orders.

Company A's production equipment is practically obsolete. There is no planned arrangement for orderly and economical production flow.

Labor is compensated on a day-work basis, in the majority of cases, with a smattering of piecework on some of the larger production jobs.

Piecework rates are established by the floor supervisors or the superintendent. They simply review time cards for past performances. No attempt is made to study the method with the idea of eliminating waste motions or cumbersome procedures.

No attempt is made to analyze departmental costs.

The only attempt at labor control is through the use of either an over-all product unit cost or a cost per pound or per ton, to get some kind of comparison of present with past over-all operations.

No budgets can be established, because there are no records of unit production and departmental costs, of waste and scrap. For this reason the only conception of cost control is the arbitrary order to "watch expenses." As long as the estimated costs indicate that any given operations are included in the original selling price estimate, the latter is accepted as satisfactory, and no attempt at refinement is made.

There is no maintenance or replacement policy for plant equipment. There is no regular inspection to determine its state of repair; equipment is repaired only after a breakdown, which causes a loss of production and high maintenance costs.

Since Company A is a one-man organization, the laboratory and development departments are held to a minimum of personnel. All their constructive effort is confined to keeping the product moving in production as smoothly as possible under existing conditions. Research and development are unknown in this organization. It gets along as best it can on the ways and means it already has. Waste and finished product loss are extremely high.

SEMI-PROGRESSIVE

are no definite lines of responsibility established between the several production departments of the plant.

Coordination between departments is lacking. Friction and jealousy are everywhere in evidence.

Planning, scheduling, and ordering of stock are more or less centralized, but are still controlled by foremen or main office without regard to quantities required or time actually needed. Promises are made promiscuously without regard to an even flow of production.

Production equipment is fairly modern. Arrangement is orderly but could be much improved. Plant layouts are made by rule of thumb. The result is often overcrowding, which adds to production costs.

The maintenance force carries an excess of manpower (often poorly supervised) in order to be in a position to hop right in with a large crew when a breakdown occurs.

There are no budget standards for the control of manufacturing prime costs or burdens. No continuous records are kept of product production or product waste and scrap. Excess plant capacity is inaccurately measured in its relation to total capacity or its effect on cost.

Every concern makes a careful count of its physical plant at least once a year. But few plant executives ever think of inventorying the management phases of the business. Or, if they do, they bump smack up against the very practical problem of what yardstick to use. This three-part article fills that need by describing the management methods of three mythical companies—one good, one bad, one indifferent. Third part will appear in November

MODERN

sponsible for the development of new equipment, product specifications, and technical service required by the sales department.

The time-study engineer is responsible for correct times and motions. It is the latter's job to see that the sequence of manufacturing operations is best adapted to economical production.

With their help the production superintendent is responsible for having the raw materials properly assembled, specifications properly followed, equipment fully utilized, waste and rejections kept to the minimum. Last but not least, he must see that production schedules are met and that costs of operations are within the limits allowed.

The laboratory is divided into research and factory control. The research division establishes formulas and strives constantly for better quality at lower cost; the control division follows original processes to see that quality is maintained. Working in cooperation with the development engineer and plant superintendent, the laboratory develops materials to compensate for production irregularities. Material costs are constantly checked.

Machinery, equipment, and methods are up to the minute. Standards have been set up for both machine-hour and man-hour output.

The manufacturing organization is charted with superintendent, department managers, foremen, and straw bosses having definite responsibilities. The staff is well organized, intelligent, and trained in the use of production systems and matters of company policy. Efficiency, safety, and low costs are the results.

Continuous records are kept of production together with waste, scrap, and departmental costs. Budget standards are established by the accounting department.

Plant equipment is physically arranged for orderly and economical production. There are no bottlenecks, no backtracking. Equipment is properly maintained. Breakdowns occur only rarely. Maintenance costs are budgeted and controlled.

Company C, in short, has an efficient staff. The men are on their toes all the time. Production is carefully planned and scheduled. Little waste and low costs are the inevitable results.

An outline for Employee Education

H. L. HUMKE
Director of Education
Servel, Inc., Evansville, Ind.

THIRTIETH IN THE SERIES OF
FACTORY MANAGEMENT AND MAINTENANCE PLANT OPERATION LIBRARY

I. Foremen

THE Foreman Training Program at Servel anticipates a continuous progress in topics to meet the need of industrial management problems. The order or topical content of the units listed will be altered to meet changing needs.

FOREMAN TRAINING UNITS

Managing Men
Human Relations in Departmental Management
Developing Standards of Foremanship
Departmental Management and Processes
Fundamentals of an Economic Social Order
Industrial Cooperation

Foremen of technical groups follow a course; however, they are placed in special classes so that consideration may be given to their superior training, and the topics under consideration may be handled in a manner suited to the experience and habits of men with considerable educational background.

In each unit, material is presented from a practical point of view. To this end the case method is freely used. To insure a "factory" approach, all courses are planned under the guidance of departmental superintendents and a supervisory committee of foremen.

Managing Men

1. Promotion Charts—Rating Sheets
2. Analysis of the Foreman's Job
3. Disposition of the Foreman's Time
4. Handling Men
5. Selecting Employees
6. Fitting the Worker to the Job
7. Instructing the Worker
8. Centralized Employment
9. The Foreman's Responsibility for Housekeeping
10. The Goal of Industrial Relations
11. Employer-Employee Relations
12. Employee Representation

Human Relations in Departmental Management

1. The Foreman's Personal Relations
2. Fitting Men to Jobs
3. Carrying Out Management's Policies
4. How to Instruct—Telling
5. How to Instruct—Showing
6. How to Instruct—Testing
7. How to Instruct—Checking
8. The Purpose of Industry
9. Planning the Work of a Department
10. Care of Materials
11. Care of Tools
12. Sources and Causes of Waste
13. Waste of Effort
14. Inspection and Quality
15. Maintaining Quality in Production
16. Personnel Procedures at Servel

Developing Standards of Foremanship

1. Personal Standards
   a. Personality—Aptitude Relations
   b. Personality and Attitudes
   c. Personality—Habit Relations
   d. Problems of the Leader
   e. The Worker and His Job
   f. Predicting the Behavior of Others
   g. Influencing the Behavior of Others
2. Standards of Departmental Operation
   h. Direct Labor Costs
   i. Indirect Labor Costs
   j. Cost of Supplies
   k. Losses, Errors, and Defects
   l. Maintenance Costs
   m. Sundry Costs

Departmental Management from the Employee's Point of View

1. Reducing Overhead
2. Cutting Costs
3. Gathering and Using Cost Records
4. Putting New Ideas to Work
5. Making the Job Safe for Workers
6. Carrying out Management Policies
7. Following the Schedule
8. Building Goodwill
9. Handling Wage Problems
10. Maintaining Quality
11. Reducing Scrap
12. The Wage Payment Plan
13. The Suggestion System
14. Supervision of the Department
15. Fitting Men to Jobs
16. Setting Standards of Time on Jobs
17. Care of Material
18. Planning the Work
19. Keeping Equipment in Order

Fundamentals of an Economic Social Order

1. Normal Standards of Life
2. Resources for Supplying Standard of Living
3. Major Trends
4. Governmental Obligations
5. Effects of Dictatorial Government
6. Free Functioning of Representative Government
7. Economic Insecurity
8. The Social Insurance Program
9. Separation of Ownership and Management
10. Financial and Non-Financial Incentives

Industrial Cooperation

1. National Interest in the Problem
2. Reconciling the Industrial System with Our Political Democracy
3. Self-Made Laws
4. Basic Human Needs
5. Control through Leadership
6. Objectives of a Sound Industrial Order
7. A Congress of Industries

(UNITS TENTATIVELY PLANNED)

Personality

1. Personality Levels of Men in Professional and Managerial Activities
2. The Backgrounds of Personality
3. Personality and Habits
4. Personality and Leadership
5. The Effect of Attitudes on Personality
6. Evaluating One's Personality
7. How Better to Put Over Our Jobs
8. Rubbing People the Right Way
9. Qualities of a Good Manager
10. Predicting the Behavior of Individuals
11. Influencing the Behavior of Individuals

Personnel Control

12. Safety Standards for Foremen
13. Standards of Effective Labor Control
14. How the Employee Looks at His Job

Standards of Cost Controls

15. Direct Labor Costs
16. A Balanced Load of Indirect Labor
17. Control of Losses, Errors, and Defects in Materials
18. Production Control
19. Minimum Costs for Adequate Maintenance

Job Improvement

20. Job Analysis
21. Motion Study

In addition to the regular units of text material issued to foremen, the Management Information Bulletins of the Elliott Service Company are distributed. These are used in two ways:

1. Current issues are commented upon, and specific cases discussed.

2. Foremen keep all back copies on file, and assignments are made to back numbers which are specially pertinent to the topic under discussion. Often a foreman is asked to make a five- or ten-minute report on some article in a selected bulletin.

Frequently, combined meetings of all foremen or foremen and superintendents (150 to 200 men) are

held. These meetings are held about three times a year. In 1935-1936 the program included speeches by the President, the Works Manager, an expert on motion economy, a practical psychologist, and a personnel man from an engineering school.

Conference leaders (for foremen meetings) are selected from divisional superintendents or men of equal rank.

Each foremanship session has a secretary who keeps attendance, a man who does the blackboard work, and a clerk who copies the boardwork. At times stenographic notes are taken. (Men acting in this capacity are those in actual attendance upon the conference). The Director attends all sessions of the foremanship conferences and makes brief notes. All notes, reports, and so forth are typed in duplicate and submitted to all conference leaders. From two to four weeks are spent on a unit (topic). At the conclusion of a unit, a Review Committee (consisting of a foreman from each conference section) makes a summary of all points brought out.

II. Group Leaders

MEN DESIGNATED as Group Leaders at Servel often are known as "straw bosses" or as "working foremen" in other institutions. They have direct control over a small group of workers. In most cases they do not have full time for supervisory activities. Each foreman has from 5 to 25 group leaders.

Meetings are held weekly or semimonthly and usually last for about one and a half hours. The foreman is in direct charge. The program follows three main divisions: (1) Shop Problems, (2) Safety, (3) Job Training. In most cases the foreman submits a report on each meeting although this is not a compulsory practice. Topics follow rather closely those used in foreman conferences. Those covered in the past are as follows:

1934-1935

Putting the Group Over
Group Cooperation
Responsibilities in Cooperation
Understanding Company Policies
Salvage
Procedure for White Slips
Instructing Men
Management of Men

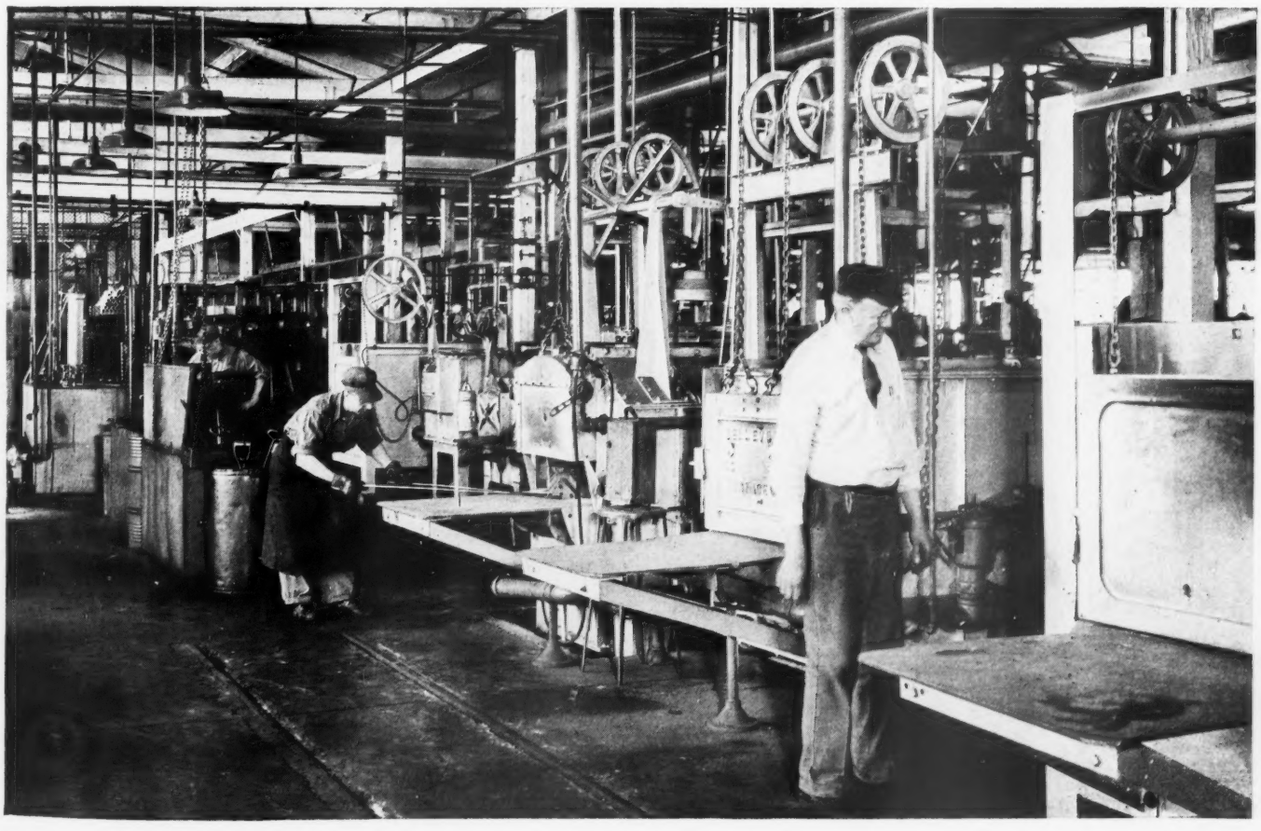
1935-1936

"Will You Save a Dime Today?"—(Waste prevention)
"Are We Standing Still?"—(Encourage new ideas)
Goodwill
Preparedness
"So It's Fate." (Need for instructing worker)
Slights and Insults
Teamwork
How to Instruct—Telling
How to Instruct—Showing
How to Instruct—Testing
How to Instruct—Checking

1936-1937

Finding Trouble
Men and Jobs
A Call from the Wild
Know Your Men
Know Yourself
Looking at the Day's Work
Showing Authority
Tools Wasting Away
Profit in the Scrap Pile
Time Marches On
The Workman Inspects His Work
Practice the Golden Rule

View of heat treating operations at Servel



III. Juniors

THE TRAINING course outlined below is offered to a selected group of younger men at Servel. In its present form it is essentially a 3- or 4-year course, which may, however, be extended.

Although it is arranged in separate inter-related sections, the sequence is such as to permit the assignment of an employee so that he might enter upon his training at the beginning of any section. Under the above plan only one unit of a course will be offered at a time. The suggested list of topics will be expanded and perhaps changed considerably as the work with the different units progresses.

The lecture period is held weekly at some set time. Men in the company who have knowledge of the special fields, teaching ability, and an interest in training are assigned to conduct lectures and quizzes. Each lecture is followed by a discussion hour, during which reports are made on related topics.

Units in the following course indicated for the "student groups" are made available to members of the Servel personnel upon recommendation of division superintendents:

Junior Training Course

Processing at Servel, Inc.
Products of Servel, Inc.
The Company and Its Business
Industrial Economics
Personality and Applied Psychology
Personnel Administration
Public Speaking
Seminar

Processing at Servel, Inc.

(Covered 1935-36)

1. Machines and Tools
2. Dies
3. Principles of Tool Designing and Manufacture
4. Paint
5. Porcelain
6. Welding

Products of Servel, Inc.

(Covered 1935-36)

1. Refrigeration and Refrigerants in General
2. Functions of the Unit and Principles of Operation
3. Mechanical Structure of the Unit
4. Gas and Kerosene Controls
5. Inspection and Tests on the Units
6. The Cabinet—Principles, Manufacture, and Inspection
7. Commercial Refrigeration
8. Air Conditioning

The Company and Its Business

1. History of the Company
2. Industrial Relations
3. The Engineering Department
4. The Financial Side
5. Sales Promotion
6. Purchasing the Needed Materials
7. The Manufacturing Division
8. Production Control
9. Standards
10. Wage Payments
11. Servicing Servel Products
12. Order and Billing
13. Functional Organization
14. Salvage Sales
15. Sales Costs and Analysis
16. Commercial Refrigeration
17. Motion Study
18. Cost Procedure
19. Accounting Procedure
20. The Sales Dollar—Distribution

Industrial Economics

1. Laws of Economics
2. Financing a Company
3. Economy in Design
4. Economy in Manufacture
5. Economy in Distribution
6. Good Business Methods and Obsolescence
7. Depreciation

Personality and Fundamental Psychology

1. Psychological Backgrounds
2. Concepts of Personality
3. Attitudes
4. Emotions
5. The Glandular Theory
6. Laws of Learning
7. Development of Personality
8. Psychology in Managing Men
9. Psychology in Salesmanship
10. Elements of Public Speaking

Personnel Administration

1. Duties of Personnel Department
2. Health and Safety
3. Selection
4. Training and Education
5. Evaluation of Personnel Activities
6. Incentives
7. Employee Relations
8. Public Relations

Public Speaking

This unit provides fundamentals of public speaking as well as actual practice in fields related to the students' experiences and interests.

Seminar

Seminar periods are planned to stimulate thinking and to train in written and oral expression. Written reports are valuable to the student in clarifying his thinking and enable the company to gain a better insight into the abilities of students.

IV. Cooperative Students

THE INSTITUTION makes provision for a limited number of young men who are employed in the institution to pursue cooperative engineering studies at the University of Cincinnati. These employees work in pairs alternating over 7-week periods in the plant and university.

They are selected on the basis of high school record, a battery of tests, and a careful interview. Whenever possible, selection is made in June or July. Between that time and the opening of the university in the fall, these new candidates are placed on probation in the factory, usually in the Foundry Division, which is the division of placement for first-year students.

The essential points in the plan are as follows:

1. Wages of co-ops are charged to the Education Budget. Pay is on an hourly basis, as follows:

Freshmen—50¢ Pre-Juniors—57¢
Sophomores—53¢ Juniors—61¢
Seniors—65¢

2. The students while in the institution are moved (without transfer notice) from position to position within the division to which they are assigned. Movement within a division follows a definite schedule jointly approved by division superintendent and Director of Education.

3. Since educational values are to be derived from acquaintanceship with menial tasks in the institution as well as from participation with workers on groups, a good portion of the time of these students is spent on the groups in such divisions as have workers on the group basis.

4. Standard learning time on a group is charged to the Education Budget.

5. On entering the group the co-op is paid at the minimum rate schedule for the type of work he is doing. His earnings on the group are credited to the Education Budget. He participates in bonus earnings of the group, if any. This amount is also credited to the Education Budget. Such bonus earnings as may accrue

to the credit of the co-op are paid and above his earnings under the schedule.

6. The institution does not guarantee the minimum of 40 hours a week for co-ops. In case the group on which he is working does not receive the full 40 hours, it is recommended that the superintendent find additional work, profitable to the company and of an educational value to the student, to complete the minimum requirements of 40 hours.

7. In case the student works 44 or 48 hours, those principles which have been indicated above apply to determine his pay.

8. During vacation periods co-op students are available to the division to which they have been assigned for the year or to work in others without adding to the budgets of the division to which they are assigned.

9. Proper procedure is set up with the Timekeeping Department to keep all data essential to the operation of this program.

10. A bonus not to exceed 10 per cent of earnings may be credited to students who during the work period have had little or no opportunity to participate in group earnings. Such bonus is based upon the combined scholastic record and shop record of said student.

11. The usual transfer and release forms are not used in changing students from one job and department to another within the division. The Director of Education takes care of all rate changes and transfers.

12. All foremen and superintendents who cooperate in this program are asked to contribute to the accuracy of records and fill out achievement rating forms at frequent periods.

V. Apprentices

PLACEMENT—New apprentices for the Tool Division spend approximately five months in the Foundry upon the initiation of their work in Servel. Old apprentices may also spend some time in the Foundry upon the approval of the Tool and Foundry superintendents. The respective items of the plans which follow, pertain very largely to the regulations which will apply to apprentices while in the Foundry and also while apprentices are placed upon group or day activities not directly productive.

Assignments—Assignment is made to the division superintendent who, in turn, assigns the apprentices to various foremen in the Foundry or elsewhere. In the Foundry, as well as in other places outside the Tool Division, the apprentices are moved from department to department without transfer. Such movements are in accord with the general schedule of activities as approved by the Director of Education and the respective superintendents.

Transfer—When apprentices are transferred from the Tool Division, they are transferred to Department Ed-83.

Hours of Work—The institution does not guarantee the apprentice forty hours of work a week; however, his training will be advanced in proportion to the total hours of activity he is able to secure. His total time employed, and not the calendar, determines the actual period of increase in pay.

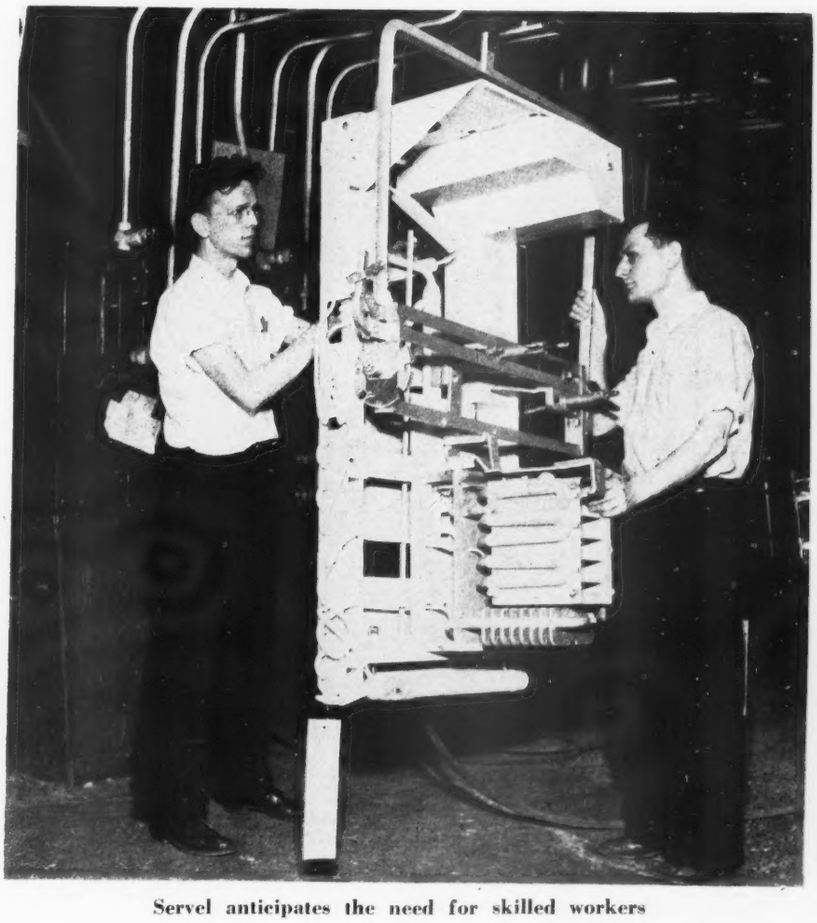
Work on the Group—If and when an apprentice is placed on a group, he is paid at his rate, (or the minimum rate for the class of work he does on the group if he can earn it). He will not participate in the group earnings as he is already on a bonus system.

Timekeeping Procedure

a. Apprentices are jointly responsible with their group leaders for issuing the indirect time card, form IBM-527251.

b. Group transfer reports must be issued in all cases where apprentices work on group.

The Apprentice's Report—At all times when an apprentice is working outside the Tool Division, he is expected to keep a check report by day to indicate the type of work on which he has been employed, the rate, if on the group, and the particular place where his work has been done. This copy is submitted to the Education Office and to the Division Superintendent. The Education Office informs the timekeeping department of the bonus which is to be paid apprentices.



Servel anticipates the need for skilled workers

APPRENTICE RATES OF PAY

First 6 months	Approximately	40%	of	average	journeyman	rate
Second 6 months	"	45%	"	"	"	"
Third 6 months	"	50%	"	"	"	"
Fourth 6 months	"	53%	"	"	"	"
Fifth 6 months	"	60%	"	"	"	"
Sixth 6 months	"	65%	"	"	"	"

A bonus is paid depending upon the quarterly rating received by each apprentice. This rating is based upon the average marks received on school and shop reports.

Just because a boy has been an apprentice for some time is no indication that he receives an increasingly higher grade, as higher standards are expected of him year after year.

Bonus payments are made at the close of each two-months period, and cover the actual number of hours worked during this period of time.

TIME ASSIGNMENTS IN FACTORY

Locations	*Tool Division*	*Foundry Division*
Foundry	5 months	
Lathes	6 "	
Shapers, Grinders, Milling Machines, etc	3 "	
Bench	12 "	
Drawing Board	4 "	
Tool Design	6 "	
Cast Iron		6 months
Aluminum		6 "
Cleaning Room		4 "
Core Room		10 "
Pattern Shop		5 "
Machine Shops		5 "

The Apprentice's Place in the Department—The placement of the apprentices should at no time result in displacement of workers on the group except as the group worker is transferred elsewhere to increase his job training. Apprentices may be used to relieve men in case regular employees do not report for work and may be substituted in case of illness of other employees. These apprentices are in the plant for the purpose of receiving an education and should be given the richest variety of experiences possible.

Tools—Each apprentice supplies himself with the tools necessary to perform the tasks required of him in his various lines of work.

Period of Employment—Time to complete the Apprentice Course is 36 months. The period of employment and the continuity of employment depend upon the qualities the apprentice continues to manifest and his ability to carry on successful class and shop work. They also depend upon any irregularities in plant operation such as may be created by fire or similar emergencies, labor disturbances, inventory or seasonal lay-offs, and any other interruptions. Failure to meet standards of progress or achievement is just cause for transfer to other lines of work in the institution or for dismissal from the institution.

Class Work

I. Prerequisites

Each apprentice must give evidence of proficiency by the end of the second year in:

1. Applied mathematics
2. Blueprint reading and sketching
3. Mechanical drawing
4. Use of precision instruments

The institution decides the methods and standards to be used in determining this proficiency.

Proficiency may be gained in the following ways:

1. High school training
2. City night classes
3. Servel opportunity classes
4. Correspondence courses

II. Related Subject Matter

The institution provides capable instructors in the following fields:

1. Metals ..... 6-9 months
2. Foundry practice... 3-6 months
3. Small tools, machines 12-15 months
4. Designing ..... 3-6 months
5. Industrial problems 3 months

Youngster learns spray painting under oldster's watchful eye

APPRENTICESHIP AGREEMENT

THIS AGREEMENT is made this ..... day of....., 1936, between Servel, Inc., doing business in Evansville, Indiana, hereinafter known as "Company" and ..... of ..... hereinafter known as "Apprentice," and ..... of ..... hereinafter known as "Guardian" whose relation to the Apprentice is that of .....

For the purpose of acquiring the Art or Trade of....., ... hereby becomes an Apprentice to the Company and the Company hereby accepts him subject to the "Terms of Apprenticeship" annexed and made part hereof, and to the terms herein stated.

The Apprentice and his Guardian hereby promise that the Apprentice shall conform to and abide by all the provisions of this Agreement and shall faithfully serve the Company during the full period of time named in this Agreement.

The Apprentice agrees during the period of his apprenticeship to do all in his power to learn said Art or Trade and to promote the interests of the Company. He also agrees to make himself proficient in such fields, to pursue such classroom studies as are required and arranged for by the Company, and to do a reasonable amount of home study in preparation therefor.

The Company agrees adequately to train and instruct the Apprentice in the principal operations of said Art or Trade.

A certificate of Apprenticeship and a statement of Recommendation and Apprenticeship Record will be issued by the ..... and signed by the officers of .....

This agreement shall cover a period of three years of work and study and may be terminated by:

a. Discharge from the company's employ for any reason whatsoever.

b. Leaving the employ of the company for any reason except a temporary lay-off or leave of absence.

c. Formal promotion to a higher position carrying with it a higher rate of pay than that hereinafter provided for an apprentice, or offering better opportunities.

....

COMPANY APPRENTICE

By ....

PARENT OR GUARDIAN

These Servel employees are typical of the hundreds who have taken courses in the Opportunity School which was inaugurated by the company three years ago

SCHEDULE OF COURSES

	Term I	*Term* II	
MATHEMATICS			
1. Beginning General Mathematics	x	x	
2. Advanced General Mathematics	x	x	
3. Shop Algebra	x		
4. Shop Trigonometry		x	
5. Slide Rule	x	x	
DRAWING			
1. Blueprint Reading	x	x	
2. Sketching	x	x	
3. Mechanical Drawing	x		
4. Advanced Mechanical Drawing		x	
TECHNICAL SUBJECTS			
1. Precision Instruments in Set-Up	x		
2. Motors and Electrical Distribution	x	x	
3. Power Plant Operation		x	Summer
4. The Electrolux Unit			Summer
BUSINESS ADMINISTRATION			
1. Office Procedures	x		
GENERAL			
1. Effective English	x		
2. Public Speaking		x	
3. Problems in Management			Summer

VI. Opportunity School

IN 1934 opportunity classes were initiated at Servel, Inc., for the purpose of helping employees:

(a) Occupy their spare time

(b) Train themselves for better jobs in the plant

(c) Equip themselves for better performances of the present job.

Hundreds of employees have taken advantage of this opportunity.

Practical Courses

Classes are taught by members of the Servel staff, thus insuring a very practical content and a more direct application of principles to the work of the factory. The program consists of two terms of approximately twelve weeks each.

The following list includes the courses that have been made available to Servel employees since the inauguration of the Opportunity School, a little more than three years ago:

Mathematics
Blueprint reading
Slide Rule
Sketching
Electricity
Mechanical Drawing
Office Procedures
Machinery's Handbook
Factory Clerical Procedures
Power Plant Operation
The Electrolux Unit
Commercial Refrigeration
Industrial Metals and Alloys
Precision Instruments
English
Public Speaking
Filing
Descriptive Geometry

Classes meet once each week for sessions of from one and one-half to two hours.

There are no registration fees. Texts and incidental materials are purchased by the individuals who enroll. Class time is spent in lectures, recitations, quizzes, and laboratory work.

A copy of the program is shown herewith. Samples of the weekly schedule of education meetings at Servel appear on the opposite and next following pages.

EDUCATIONAL SCHEDULE

DATE.....

DAY	HOUR	GROUP	PLACE	INSTRUCTOR
	10:45 a.m.	Foreman Conference	School Room No. 1	A. H. Counts
	1:00 p.m.	Inspectors Meeting	School Room No. 1	G. Roy Moon
	4:00	Group Leader Meeting	School Room No. 1	H. Carrico
	5:00	Beg. & Adv. Mathematics	School Room No. 2	Woodworth—Powell
	5:00	Adv. Elux. Unit	School Room No. 1	Phil Anderson
MONDAY	5:00	Engineering Blue Print Class	Library	
	6:00	Filing	School Room B	Geo. Wright
	7:00	Beg. & Adv. Mech. Drawing	School Room No. 2	Walter Simpson
	7:00	Beg. Elux. Unit	School Room No. 1	H. W. Fillmore
	7:00	Adv. Precision Instruments	Power Plant	W. E. Gibbons
	8:00	Inspectors Meeting	School Room No. 1	G. Roy Moon
	8:30 a.m.	Adv. Elux. Unit	School Room No. 1	Dr. Buffington
	10:45	Foreman Conference	School Room No. 1	K. Reynolds
	3:00 p.m.	Group Leader Meeting	School Room No. 1	J. Douglas
	4:00	Group Leader Meeting	Wood Mill	C. Beyer
	4:00	Inspectors Meeting	Waiting Room	F. Schorle
TUESDAY	5:00	Beg. Precision Instruments	School Room No. 1	Morrell Young
	5:15	Commercial Refrigeration	Sales Display Room	W. J. Aulsebrook
	7:00	Sketching	School Room No. 2	Ralph Erwin
	7:00	Adv. Electrical	Library	M. A. Raney
	7:30	Group Leader Meeting	School Room No. 1	F. Gill
	8:00	Group Leader Meeting	Dept. 43	C. N. Taylor
	8:00	Men's Glee Club	Waiting Room	
	8:30 a.m.	Beginning Elux. Unit	School Room No. 1	V. Drier
	10:00	Beg. & Adv. Mathematics	School Room No. 2	L. McNeeley
	10:45	Foreman Conference	School Room No. 1	O. J. Dail
	1:00 p.m.	Group Leader Meeting	Plant V	A. McGinness
	1:00	Engineering Foremen	School Room No. 2	Ritch Harold
WEDNESDAY	4:00	Machinery's Handbook	Waiting Room	O. Kampschaefer
	4:00	Workers' Council	School Room No. 1	
	5:00	Blue Print Reading	School Room No. 2	L. McBride
	6:30	English—Public Speaking	Library	Eberlin—Roth
	6:30	Tap Dancing	School Room No. 1	Art Maholm
	7:00	Descriptive Geometry	Mfg. Office	J. A. Kimm
	7:00	Alg. Geo. & Trig.	Waiting Room	Leon Mooradian
	9:00 a.m.	Blue Print Reading	School Room No. 1	Chas. Scheller
	10:45	Foreman Conference	School Room No. 1	Fred Creech
	3:00 p.m.	Group Leader Meeting	School Room No. 2	L. F. Joest
	6:00	Boy Scouts	Waiting Room	
THURSDAY	7:00	Group Leader Meeting	Library	Daugherty
	7:00	Junior Training Group	Evansville College	
	7:00	Fire Brigade	School Room No. 1	
	7:00	Group Leader Meeting	Education Office	F. Gibson
	7:00	Group Leader Meeting	School Room No. 2	H. Axford
	9:00 a.m.	Sketching	School Room No. 2	Noble West
	9:30	Master Session—Foreman Conference	School Room No. 1	
	10:45	Foreman Conference	School Room No. 1	C. E. Johnston
	12:00	Junior Conference Leaders	Library	
	2:00 p.m.	Group Leader Meeting	School Room No. 2	D. C. Davis
	2:00	Foreman Conference	School Room No. 1	C. T. Geyer
	4:00	Industrial Metals	School Room No. 1	R. A. Major
FRIDAY	5:00	Group Leader Meeting	School Room No. 2	Dukes—Pierce—Gerard
	5:00	Slide Rule	Education Office	Arthur Ullman
	5:00	Group Leader Meeting	Dept. 61	Gil Meyer
	5:00	Group Leader Meeting	Service Office	A. Van Ness
	6:30	Tap Dancing	School Room No. 1	Art Maholm
	7:00	Group Leader Meeting	Library	N. Miller
	7:00	Group Leader Meeting	Power Plant	Frank Wallace
	8:00	Men's Glee Club	Waiting Room	

NOTE:—This is a permanent schedule. A copy with weekly corrections will be posted on each school room door.

TENTATIVE OPPORTUNITY SCHOOL SCHEDULE

Second Semester

SPRING—1937

Beginning—Monday, February 22, 1937

DATE	TIME	CLASS	PLACE	INSTRUCTOR
MONDAY	5:00 p.m.	Beginning & Adv. Math.	School Room No. 2	Woodworth & Powell
Feb. 22	5:00	Adv. Elux. Unit	School Room No. 1	Phil Anderson
	6:00	Filing	Library	George Wright
	7:00	Adv. Mech. Drawing	School Room No. 2	Walter Simpson
	7:00	Beg. Elux. Unit	School Room No. 1	H. W. Fillmore
	7:00	Adv. Precision Instr.	Power Plant	W. E. Gibbons
TUESDAY	8:30 a.m.	Adv. Elux. Unit	School Room No. 1	Dr. Buffington
Feb. 23	9:00	Beg. Precision Instr.	School Room No. 2	A. N. Angel
	5:00 p.m.	Sketching	School Room No. 2	Ralph Erwin
	5:00	Beg. Precision Instr.	School Room No. 1	Marvel Young
	7:00	Advanced Electrical	School Room No. 2	M. A. Raney
WED.	8:30 a.m.	Beg. Elux. Unit	School Room No. 1	Victor Drier
Feb. 24	9:00	Beg. & Adv. Math.	School Room No. 2	Lowell McNeely
	4:00 p.m.	Machinery's Handbook	Waiting Room	Otti Kampschaefer
	5:00	Blue Print	School Room No. 2	Leslie McBride
	6:30	English—Public Speaking	Library	Eberlin—Roth
	6:30	Factory Clerical	Sales Room	Litherland—Ferguson
	7:00	Descriptive Geometry	Manufacturing	J. A. Kimm
	7:00	Alg. Geo. & Trig.	Waiting Room	Leon Mooradian
THURS.	9:00 a.m.	Beg. & Adv. Mech. Drg.	School Room No. 2	Edgar Downs
Feb. 25	9:00	Blue Print Reading	School Room No. 1	Charles Scheller
	2:00 p.m.	Machinery's Handbook	School Room No. 1	Joe Lane
	5:00	Elux. Unit (Foremen & GL)	School Room No. 1	Dr. Ashby
FRIDAY	9:00 a.m.	Sketching	School Room No. 2	Noble West
Feb. 26	4:00 p.m.	Industrial Metals	School Room No. 1	R. A. Major
	5:00	Slide Rule	School Room No. 2	Arthur Ullman

Beginning Mechanical Drawing will not be offered unless as many as twenty-five (25) wish it.
Anyone interested should report to the class 9:00 a.m. Thursday.
Any class which does not have sufficient enrollment may be discontinued.

NO INDIVIDUAL NOTICES ARE SENT OUT—REPORT TO THE CLASSES YOU DESIRE.

VII. Library

THE Servel library reading room was opened January 1, 1937. Since that time this phase of educational work at Servel has been very well received. There is a growing interest in the services that the library is able to render. The reading room is beginning to serve a very definite purpose, particularly during the regular noon hour.

Many employees of the institution are cooperating with this important part of the educational program by contributing magazines and books that they think will be useful to other members of the company.

Material Is Circulated

Books and pamphlets are circulated on request and a definite card record is kept. The company subscribes to a large number of magazines of a general management or business nature. Most of these are received at the Servel library. Circulating slips containing the names of the men who are to see each issue are attached, the material is rapidly reviewed, and page notations which are thought to be of interest to any particular individual are made.

Considerable care is exercised in the purchase of books, in order to avoid filling the library shelves with material which will have only limited circulation. There has been an increasing number of requests from foremen and superintendents for special magazines and books. Each of these requests has been carefully considered before the material has been purchased. The Director of Education approves all book purchases for the entire institution. A record of all these purchases is kept in the Education Department.

The library for Servel, Inc., is in its infancy. Although the number of volumes owned by the library at present is less than 300, considerable help is given to a busy foreman in securing from the public library such additional material as he needs.

In addition to books, a large number of pamphlets are available.

Library material may, on request, be routed among company employees. It is encouraging to note that more use is being made of this method of circulating information.

Library Is Growing

At present only a few magazines are taken for use in the main waiting room or cafeteria of the Recreation and Employment Building. However, it is anticipated that with the new library room this number will be increased.

Typical scene during noon hour in the Servel library reading room

VIII. Correspondence Study

WHILE we do not wish to have any control over the correspondence work or to discourage any employee, we do feel that we should offer guidance upon request. The employee's possibilities of development and his likelihood of finding opportunity for service and for an increase in wage at such time as he may have completed the course should be considered.

Consequently, we urge correspondence school representatives to advise our employees to confer with foremen or superintendents before a contract is signed for a course. If the course would be of questionable value to him or he would find it difficult to meet payments, he should be advised to take work in the night school at Central High School or enroll in classes at the Servel Opportunity School.

Arrangements under this plan shall not be construed as implying any responsibility of the company for payment of lessons, books, or equipment.

Reports of the grades of the individuals who have completed certain units of study are received from the schools. These reports are forwarded to the man's superintendent, who passes them to the foreman.

When an employee graduates, he receives a letter from the Director of Education complimenting him on his persistence and ambition. The superintendent receives a similar letter asking him to keep in mind this special training for further usefulness in the institution. Notation is also made on the permanent record of the employee in the Employment Office.

The correspondence students have formed a club which meets once a month at night on Servel property. Consideration is being given to furnishing a room for supervised study.

IX. Special Lectures and Executive Development

TOP MANAGEMENT must appreciate the need of an educational program. Any effort at foreman training without the full support of top management will be ineffective. Further, top management must demand that the results of foreman training be evaluated. Servel, Inc., is definitely committed to a research program which has as its major purpose an evaluation of progress in achievement of standards of foremanship and personnel. A periodic check is necessary.

Management must have the understanding, wisdom, and courage to take the long-time view of foreman training. Standards of achievement in any institution cannot be built without the proper human material. Those who are responsible for the training program must be able to make themselves heard in the development of policies of employment and promotions.

Leaders for developing standards must be trained. This takes patience and time. It seems futile to attempt to achieve much in the field of foremen training unless at the same time top management has definitely committed itself to a careful study of much the same type of material as is presented to the foremen.

Special lectures are arranged from time to time, particularly for foremen and superintendents. These speeches are on current subjects, usually related to the series of topics being considered in foremen conferences. Speakers are from within as well as from without the membership of the organization.

Additional activities for assisting executives to keep abreast of educational needs for industrialists are:

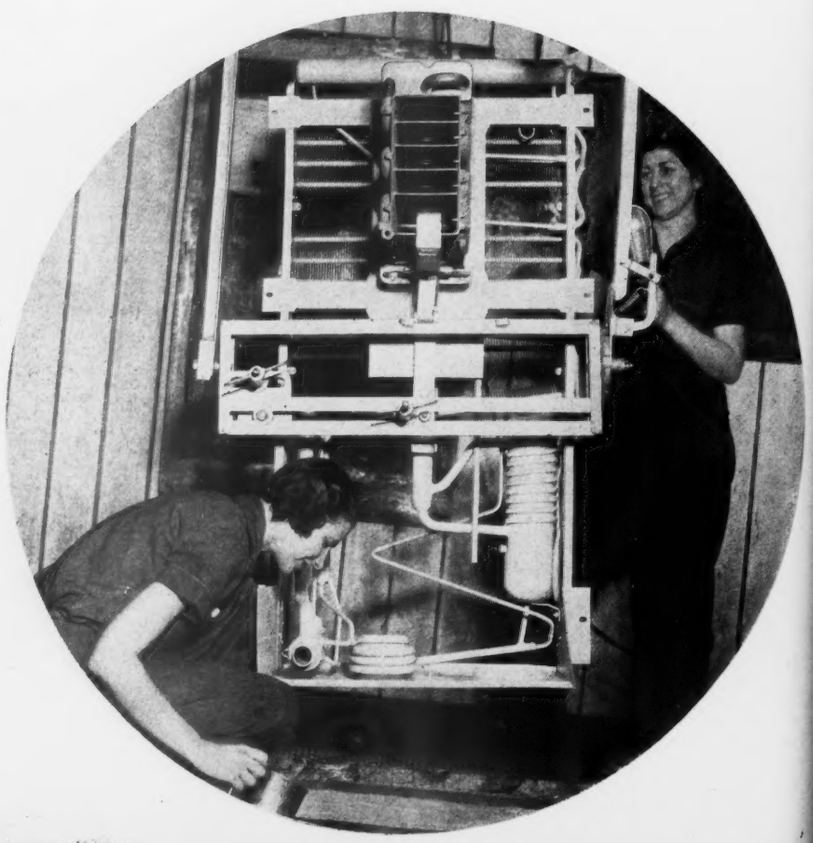
1. Direction of educational features through the line organization. This feature consists at present of contact with the weekly Divisional Meetings of Superintendents with their foremen. An outline of items of industrial relations which can be presented in such meetings has been prepared. The director, through his personal attendance at these meetings, is able to give impetus to the personal educational needs of foremen, to keep safety education alive, and to gain a wealth of shop information which is invaluable.

2. Summaries of Industrial Relations Conferences are presented:

   a. In written review to "top management"

   b. In conference review to about thirty key men in both offices and factory divisions.

3. Efforts are made to keep supervisors and executives in touch with all phases of developments in the industrial relations field. Special features of the social, legislative, and labor phases of these developments are referred to the President and Vice-Presidents.



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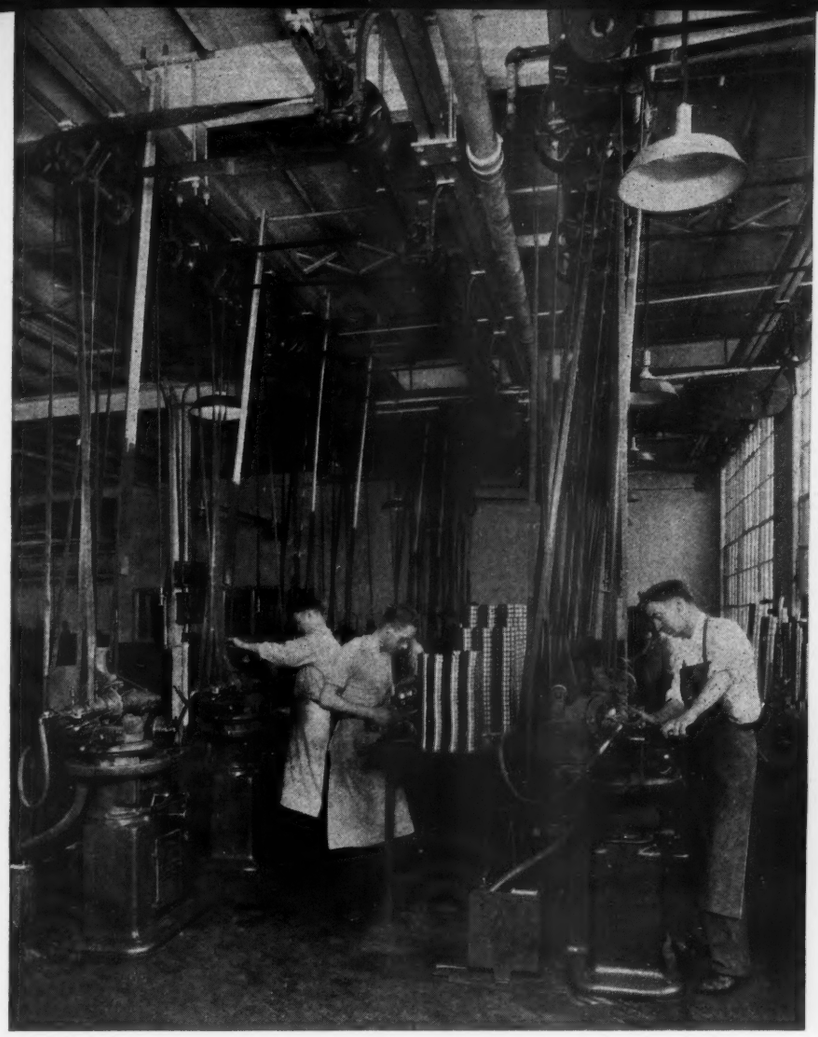


When we built our new plant, we took into it power drive methods that had been proved over a long period of years

The "Why" of Our Power Drives

B. S. OKNER

Chief Engineer
Ahlberg Bearing Company
Chicago

WHEN WE MOVED into our new plant a few months ago there was one question that did not come up—namely, What kind of power drive? We have always used group drives wherever possible, and nothing in our experience with them has indicated that we would be justified in abandoning them in favor of something else.

From past experience and a careful study of the various factors involved in operating our race grinders and polishing machines, 65 in all, we decided that for most practical results we would continue to use group or lineshaft drive.

Prominent among the factors for our decision is that ball bearing race grinding is precise rather than heavy work. Absolute freedom from vibration in the machines is essential in order to secure the finish necessary for quiet bearing operation, and power transmitted through uniform thickness belts gives us the most satisfactory results. Machines for doing this work do not require much power to drive them. On the other hand a considerable number of machines are needed to handle a large volume of production, and these machines readily lend themselves to grouping in batteries. Hence they are well adapted to group or lineshaft drive.

Batteries of Eight

Normal size grinders consume only 1¼ hp., and by setting them up in batteries of eight machines using a 10-hp. motor, we find the power factor efficiency high and the cost of power consequently low. Larger machines using 2¼ hp. are operated in two groups of four using one 15-hp. motor.

It will simplify matters to consider the group drives in the grinder department alone. The layout of this department is shown in Figure 1. It will be seen that there are eight lineshaft groups, each of which is composed of two or three sections of 1 7/8-in. shaft.

Lineshafts composed of two sections are about 35 ft. long, whereas those with three sections run about 60 ft. All except two of these groups are driven by 1,200-r.p.m., three-phase motors of 5-, 7½-, 10-, or 15-hp. rating. In the case of the other two lineshafts, it was considered desirable to drive them, at least for the present, by one motor. A cross-belt transmits power from one shaft to the other.

Silent chain drives inclosed in oil-tight steel casings are used between the motors and the lineshafts, which are driven at approximately 400 r.p.m., which is faster than usual. We considered it advisable to use chain drives here because the center

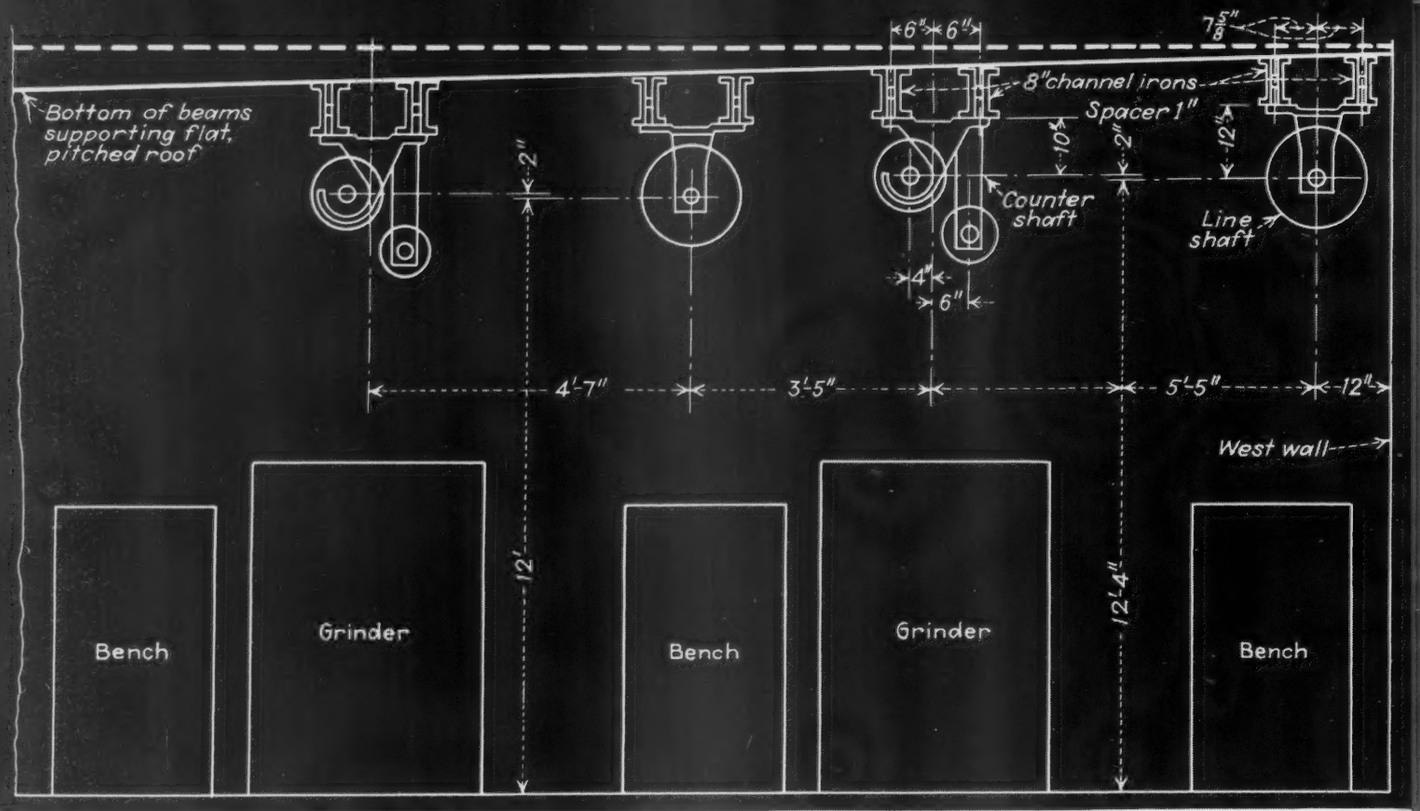


Figure 1. This is how the grinder department is laid out

distances are comparatively short. Furthermore, chains give us a positive, unchanging speed ratio between the driven motors and the lineshafts.

As everyone knows, it is essential that lineshaft hangers be rigidly mounted on a strong supporting structure. It is also highly desirable to mount them in such manner that they can easily be shifted, if changes in the location of machines make it necessary to move them.

Fortunately, the construction of the building made it possible for us to meet these requirements without much trouble. The flat roof over the shop is supported by I-beams that for the most part are more than heavy enough to support the weight of the line- and countershafts. In a few places it was necessary to reinforce beams or other parts of the structure, but we encountered comparatively little trouble in doing so.

Rigid Mounting

To the I-beams supporting the roof we bolted 7- or 8-in. channel irons, as required. These channel irons, of course, run at a right angle to the I-beams. Hangers for the lineshafts and countershafts were then bolted to the channel irons, as shown in Figure 2. Lineshaft hangers are spaced not more than 8 ft. apart, frequently less where it was necessary to get one close to the chain drives on the shafts, or to the points where power is taken off.

The principle on which our grinding machines operate makes it necessary to use a ball-bearing countershaft of special design with each one. These countershafts are driven through leather belts at a speed of 1,100 r.p.m. In place of the usual single belt there are three leather belt drives from each countershaft to its grinding machine. Two of these drives are required to operate different parts of the machine; the third drives the coolant pump.

High-Speed Jobs

Grinding and polishing are necessarily high-speed operations; so the heads of our machines turn at 10,000 to 16,000 r.p.m., depending on the size of the machine. This speed is obtained, of course, by driving from a large pulley on the 1,100 r.p.m. countershaft to a small pulley on the head.

Notching spindles are driven at considerably higher speeds—up to 30,000 r.p.m. These speeds are obtained, in turn, by driving the spindle from the machine head through a light canvas belt that runs on pulleys of such diameter that the speed is increased in the ratio of about 2 to 1.

It will be noticed that the lineshafts and some of the belts operate at speeds in excess of those usually found in group drives. Despite this fact we have very little trouble with our power transmission equipment. This is due to careful maintenance.

For example, maintenance of proper alignment is highly important with any lineshaft; it is absolutely essential when the shaft turns at high speed. Even though the equipment has been properly installed, it is necessary to check the alignment from time to time, in order to make sure that it is maintained. We expect to make such checks about once a year, as a routine procedure.

Line- and countershaft hanger bearings will be inspected and greased, if necessary, twice a year.

All belts from lineshafts to countershafts are carefully inspected about once every three months, and any defects are repaired at once. The belts that transmit power from the countershafts to the grinders travel considerably faster than the others; therefore we give them more attention. They are examined, and repaired, if necessary, about every two weeks. All this work is handled on a definite schedule.

Avoid Serious Delays

It does not take long for an experienced mechanic to detect defects in belts and other equipment that will sooner or later lead to trouble or complete breakdown. By promptly locating and remedying all such weak spots, we obtain maximum service from our power transmission equipment and avoid any serious production delays.

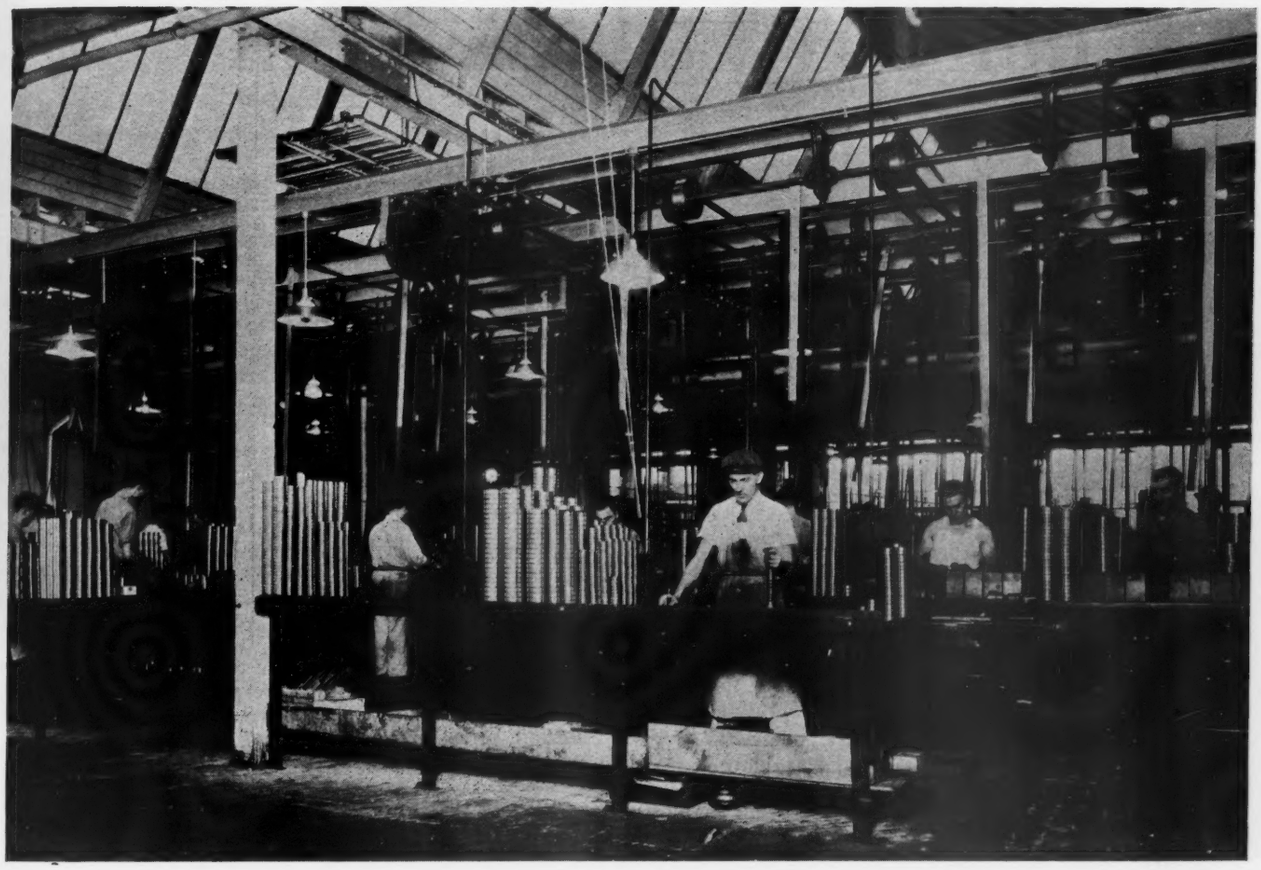
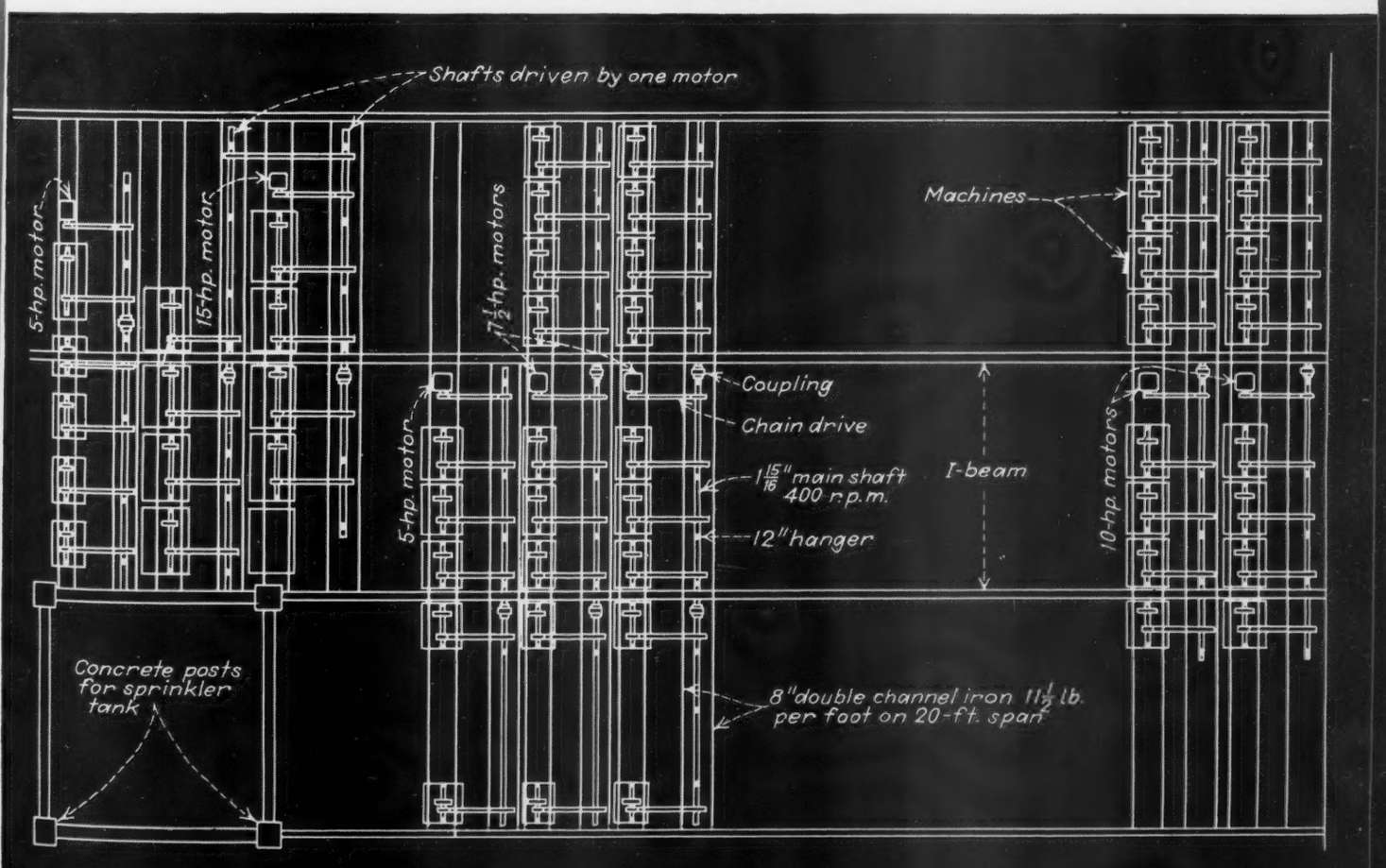


Figure 2. Lineshafts and countershafts are mounted on channel irons bolted to the I-beams supporting the roof



Industry Lighting Studies

3. Textiles

Picking, Carding, Drawing, Slubbing, Intermediates

DEAN WARREN
Engineering Publications
Nela Park Engineering Department
General Electric Company, Cleveland

THIS INVESTIGATION confined itself to a study of the seeing problems in the gray goods and denim mill, because the operations here are fairly typical of those performed in a large proportion of textile mills.

From the tests made by the committee with the aid of the visibility meter have come the following lighting recommendations for the different seeing operations performed in gray goods plants. Alternative recommendations are given in some instances where it was felt that a single recommendation would not satisfactorily meet all requirements.

Picking

This is a machine operation, and the seeing problem is not particularly difficult. All that is required is light of the order of 5 footcandles on both sides of the machine so that the operator can see to make adjustments. Figure 1*A* shows one lighting layout for the single-process picker. Here 18-in. industrial diffusing units equipped with 200-watt Mazda lamps and mounted 12 to 14 ft. high provide the necessary footcandles. In accordance with good lighting practice the distance between the units should not exceed the lowest mounting height.

Figure 1*B* shows an alternative lighting layout consisting of 300-watt incandescent lamps in 20-in. reflectors mounted 14 ft. high.

Figure 1. Picking

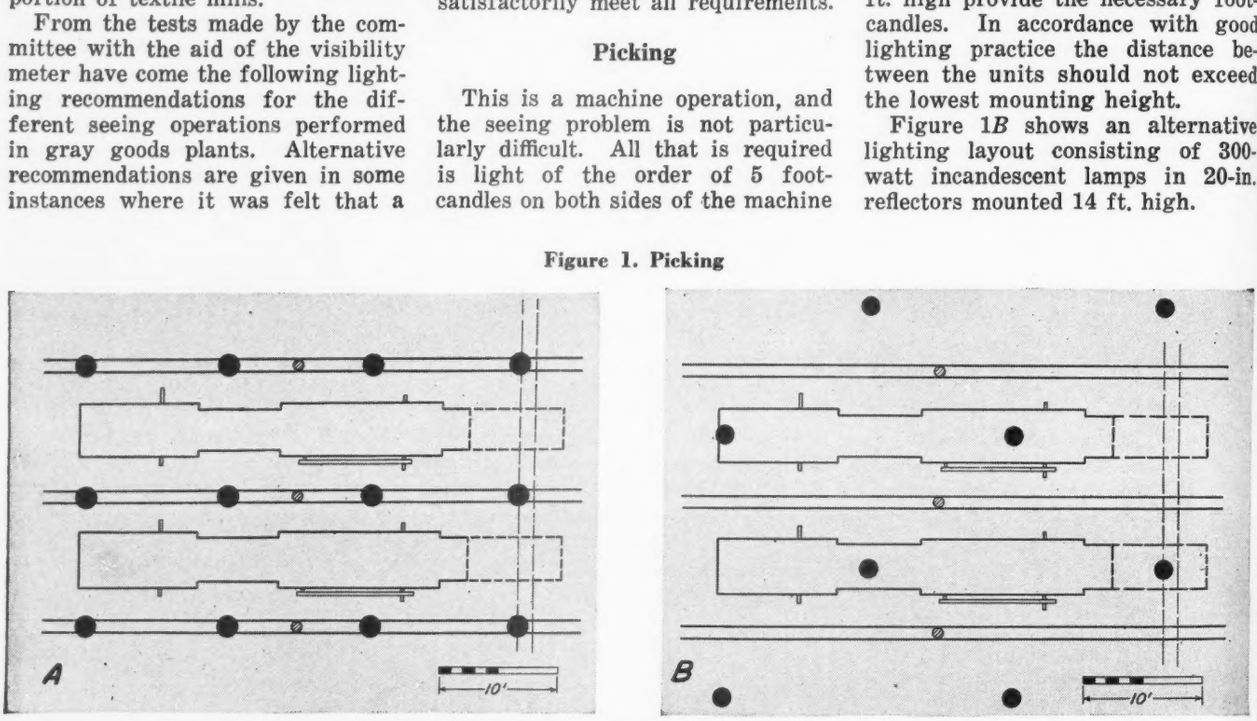
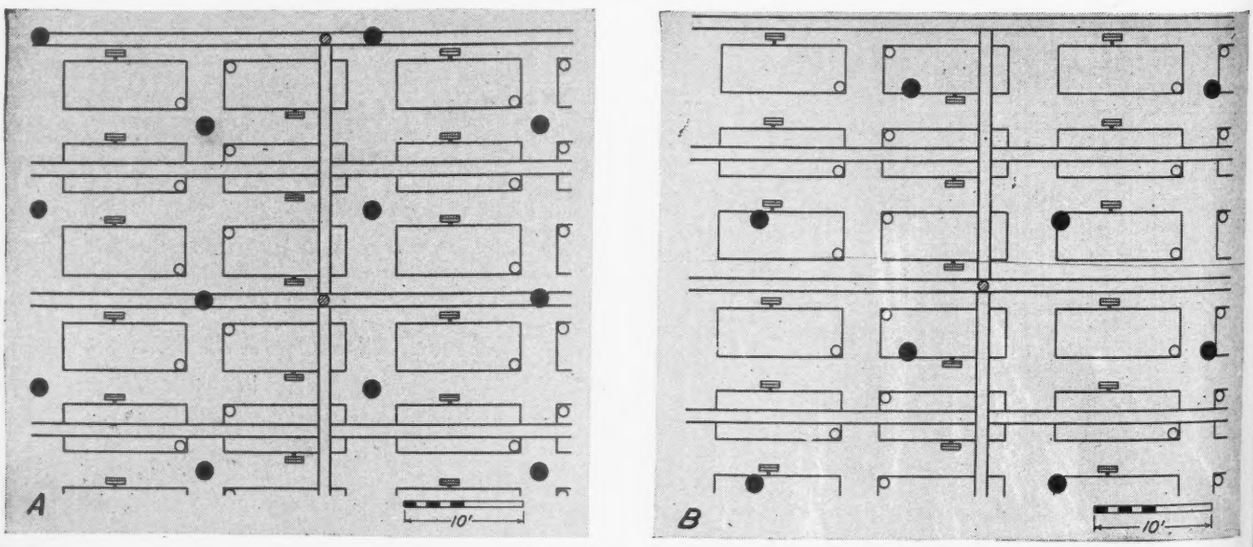


Figure 2. Carding



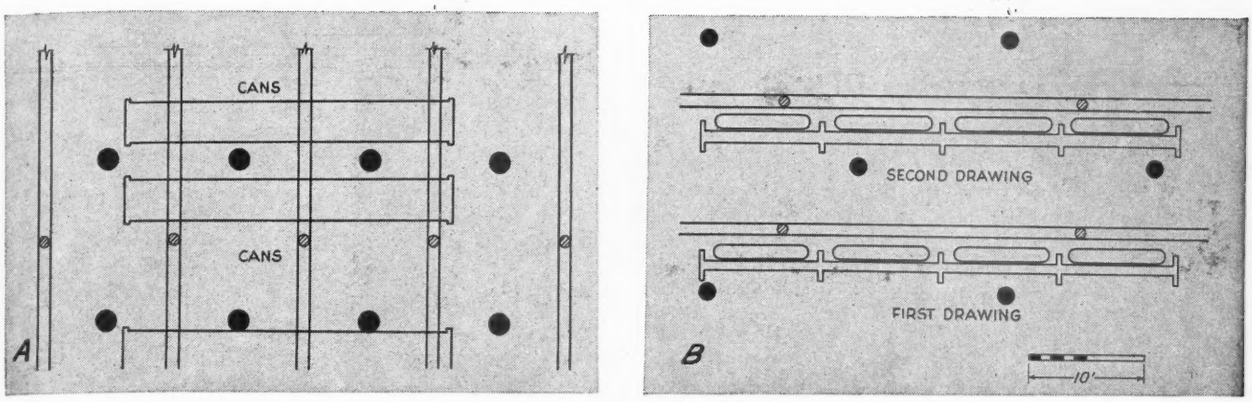


Figure 3. Drawing

Carding

Here again the seeing requirements are satisfactorily met by providing approximately 5 foot-candles of illumination. Figure 2*A* shows a lighting system carefully arranged to provide enough illumination to enable the operator to keep the cards supplied with picker laps, and reunite any break in the web or sliver. Eighteen-inch industrial diffusers are equipped with 200-watt lamps and mounted 12 to 14 ft. high.

Figure 2*B* shows an alternative lighting layout for the card room, using 300-watt incandescent lamps in 20-in. industrial diffusing reflectors and mounting them 14 ft. high.

Drawing

In this operation six slivers are fed into the machine in parallel and then drawn by rolls and combined into one that is approximately the same size as each of the original slivers. Each frame has an automatic stopping motion which halts a section of the frame whenever a break or run-out occurs.

The visual task performed here is that of locating the break and restoring the frame to operation. Figure 3*A* shows a recommended lighting layout using 200-watt lamps in 18-in. industrial diffusing reflectors. The units are mounted 14 ft. high and spaced approximately 12 ft. along the front edge of the cover over the drawing rollers. The calculated average illumination afforded by this lighting installation is 6 foot-candles.

Figure 3*B* shows an alternative lighting layout consisting of 300-watt lamps in 20-in. industrial diffusing units mounted 14 ft. high and staggered, as in the alternative lighting layout for the carding room, one per bay-division.

Slubbing

These machines, which are relatively low, take the sliver from the cans filled at the second drawing frames, draw it on rollers, and twist and wind it on a bobbin.

Figure 4 shows a recommended lighting layout consisting of 300-watt incandescent lamps in 20-in. industrial diffusing units mounted 12 to 14 ft. high and spaced two per bay-division. An intensity of 13 foot-candles is recommended.

Intermediates

The operation performed is similar to that of slubbing. Here the bobbins are placed in a creel on the back and top of the machine, which puts two slivers together and makes them into one.

Figure 5 gives the lighting recommendations, consisting of 300-watt incandescent lamps in 20-in. industrial diffusing reflectors. The units are mounted 14 ft. high and spaced approximately 11 ft. apart to provide approximately 14 foot-candles on the spindle alleys and 10 foot-candles on the roving alley.

Where the bay width is up to 12 ft., units may be symmetrically spaced along the alleys.

Figure 4. Slubbing

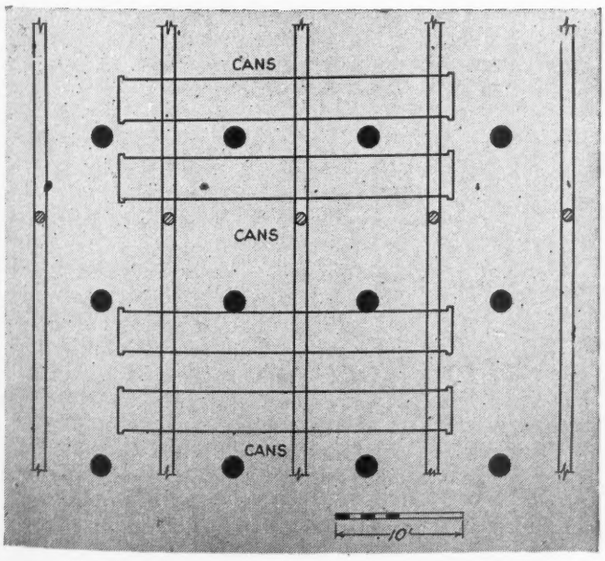
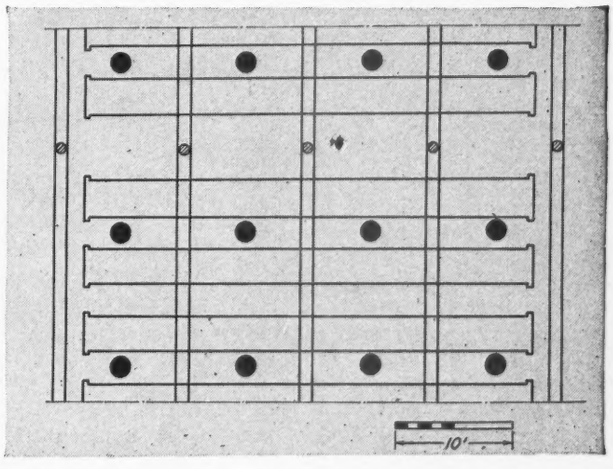


Figure 5. Intermediates



When a circuit is to be opened, the main switchboard operator pulls the oil switch and attaches the *Danger* tag to it

Safety Is a "Must" for Ford Electricians

When work is done on power circuits at Ford's Rouge plant, ironclad routine governs their opening and closing, makes accidents impossible

ARTHUR VAN VLISSINGEN
Consulting Editor

SAFETY PRECAUTIONS taken when work is to be done on the electric power lines in the Rouge plant of the Ford Motor Company have been embodied in a routine that is strictly enforced. Disregard of any of the regulations is the automatic signal for discharge of the violator. Hence, there are very few violations.

Every switch in the system may be locked open when the circuit it controls is out of commission, or is being worked on. Switch keys are kept in glass-doored keyboard racks in the custody of switchboard operators. Each key is tagged.

A mimeographed Operators Notice Slip, and a white, red, and black *Danger* tag complete the system.

The Operators Notice Slip must be filled out by someone with authority to request a shutoff—namely, a construction or maintenance foreman.

This slip must be presented to the chief switchboard operator at the main power house and at all substations. The foreman personally presents the slip and watches the

Form 11317
4-25-35

OPERATORS NOTICE SLIP

DISCONTINUE SERVICE ON THE FOLLOWING:	RESTORE SERVICE ON THE FOLLOWING:
POWER LINE	POWER LINE
MOTOR-GENERATOR	TURBO-GENERATOR
TURBO-GENERATOR	MOTOR-GENERATOR
TRANSFORMER BANK	TRANSFORMER BANK
SYNCHRONOUS MOTOR	SYNCHRONOUS MOTOR
INDUCTION MOTOR	INDUCTION MOTOR
DIRECT-CURRENT MOTOR	DIRECT-CURRENT MOTOR
440-VOLT OIL SWITCH	440-VOLT OIL SWITCH
250-VOLT MACHINE BREAKER	250-VOLT MACHINE BREAKER
250-VOLT D.C. FEEDER BREAKER	250-VOLT D.C. FEEDER BREAKER
440-VOLT CIRCUIT BREAKER	440-VOLT CIRCUIT BREAKER
REASON	REASON
REQUESTED BY	REQUESTED BY
CHIEF OPERATOR	CHIEF OPERATOR
SUB-STATION OPERATOR	SUB-STATION OPERATOR
TIME DATE	TIME DATE
SUB-STATION NUMBER	SUB-STATION NUMBER
POWER HOUSE NUMBER	POWER HOUSE NUMBER

Service is discontinued, or restored, only upon presentation of this slip, which must be signed by an authorized person

operator open the oil switch, fill in the *Danger* tag, and affix it to the oil switch. Next he follows the operator down to the bus wall and watches him open the disconnecting switch—and is jointly responsible with the operator for double-checking the number of the power line.

The Foreman Keeps the Key

The operator now locks open the disconnecting switch with the key obtained from the rack. The foreman takes this key and keeps it in his possession until the work is completed. Going to the substation he shows the substation operator the key and notice slip from the main switchboard operator. Then the substation operator must check with the main switchboard operator by telephone to make sure that the power line is open.

When the substation operator has this telephoned word, he may open the power line oil switch, and then open the compartment and pull the disconnects. The power line must then be tested with a ground stick, with the oil switch closed.

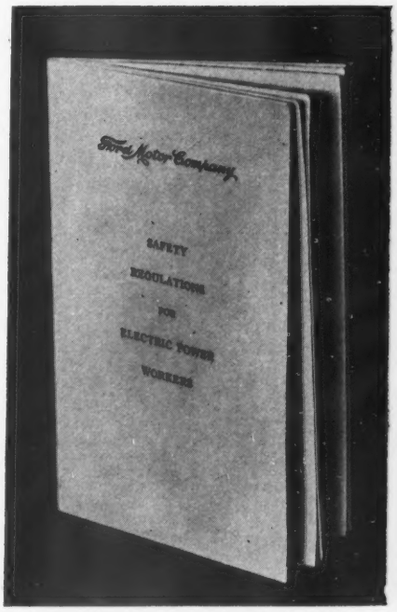
When the work on the line is completed and the foreman wishes to restore service, it is his responsibility to see that all men are clear and that the switch compartment is securely locked. He now returns the key to the main switchboard operator, removes the *Danger* tag from the oil switch, and signs the "Restore Service" side of the Operators Notice Slip.

The main switchboard operator then checks back to the substation operator by telephone, and when he has word that the power line is clear, he restores service.

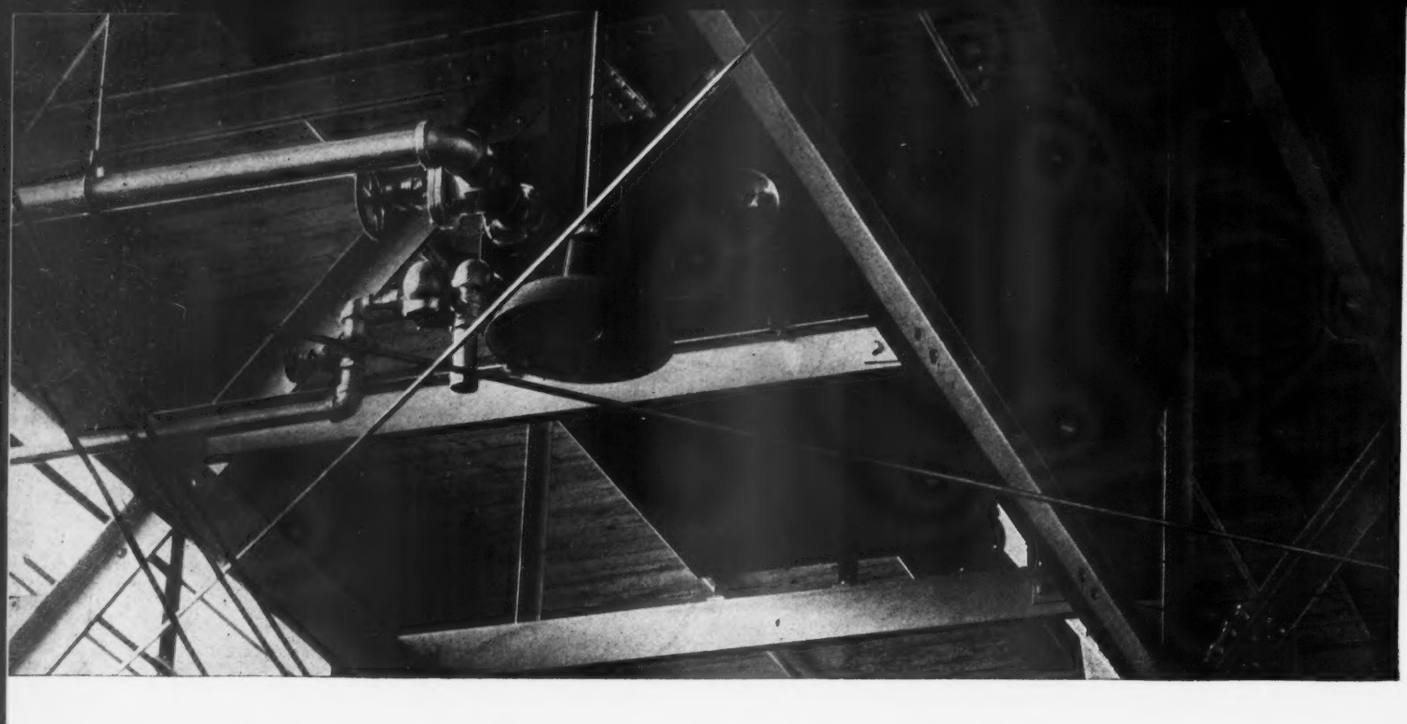
The regulations described cover only work on power lines between Power House No. 1 and all substations. Comparable regulations, varied to fit the specific situations, are in effect for all other major shutoffs, such as outdoor transformer banks fed directly from Power House No. 1; outdoor transformer banks fed directly from a substation; or equipment housed in the substation or power house proper and controlled from the various bus walls.

The only telephone conversations permissible in the routine are those between substation chief operator and main switchboard chief operator, thus eliminating any irresponsible claims of telephoned authorization. The main board operator logs such communications.

In practice the routine is much less cumbersome than its description. It has become second nature with Ford workers, and is followed as a matter of course.



Electrical safety rules are all down in black and white in this pocket-size book of regulations



Give Unit Heaters a Break

Best results are obtained with thermostatic control, and proper connection to the steam supply is essential to satisfactory service

C. E. SCOTT
Engineer, Carrier Corporation
Newark, N. J.

THE PRECEDING ARTICLE, in the September issue, discussed the selection and location of unit heaters for maximum efficiency and fuel economy. After the correct type of unit for the conditions has been picked out, the next step is to see that it is properly installed and controlled. These important matters will be taken up in this article.

Operation of units will always be more satisfactory if they are placed under thermostatic control. The simplest control consists of a thermostat which will start and stop the fan motor. Up to certain limits of horsepower the thermostat can carry the running current of the motor without auxiliary devices. When this current is beyond the capacity of the thermostat it is necessary to use a contactor.

The control may be elaborated by using a clamp-on type thermostat in series with the room thermostat. This device is attached to the return pipe from the unit and will break the circuit if the steam supply fails or is insufficient, thus preventing the unit from blowing cold air.

Other arrangements are available, such as a thermostat and electric damper motor to control operation of the bypass on blower-type units.

Locate the thermostat in a position where it will register the most representative temperature. It should not be located on an outside wall, or in the direct line of blow from a unit. An elevation of 5 ft. is usual.

Always use an approved thermal protective device for *each* individual motor. With unit heater motors, fuses alone will not give adequate thermal protection, unless they are of very special design.

No unit heater will function with full efficiency unless it has been installed properly, with the required accessories. Many errors are made in hooking up unit heaters; often a unit may be condemned when nothing but the hook-up is at fault.

Keep These Points in Mind

The following general points should be kept in mind when designing steam piping layouts:

1. Coils in unit heaters are assembled with the proper pitch for drainage; therefore, the unit should be installed in a level position.

2. Avoid dripping steam mains into unit heaters.

3. A separate trap must be used for each coil. If the unit has two or more coils, use two or more traps.

4. When check valves are used the flappers should hang 15 deg. from the vertical.

5. Float or bucket traps are usually used. Thermostatic traps may be employed, provided a sufficiently long condensate "cooling leg" is inserted between the trap and the return header.

6. Air vent lines to which thermostatic traps are attached must be properly pitched to assure free venting of the air.

7. Return outlet connections must be dropped vertically 12 to 18 in. to assure sufficient static head to force condensate through valves, etc.

8. Anchor and support steam mains, return mains, and risers independently of unit heaters.

9. Steam mains and branches should be installed with ample provision for expansion and contraction.

10. In low-pressure, closed, gravity systems the bottom of the unit must be at least 30 in. above the water line of the boiler, and thermostatic control on the steam supply lines must be avoided.

11. When unit heaters are used to heat outside air which may enter the unit below freezing temperature,

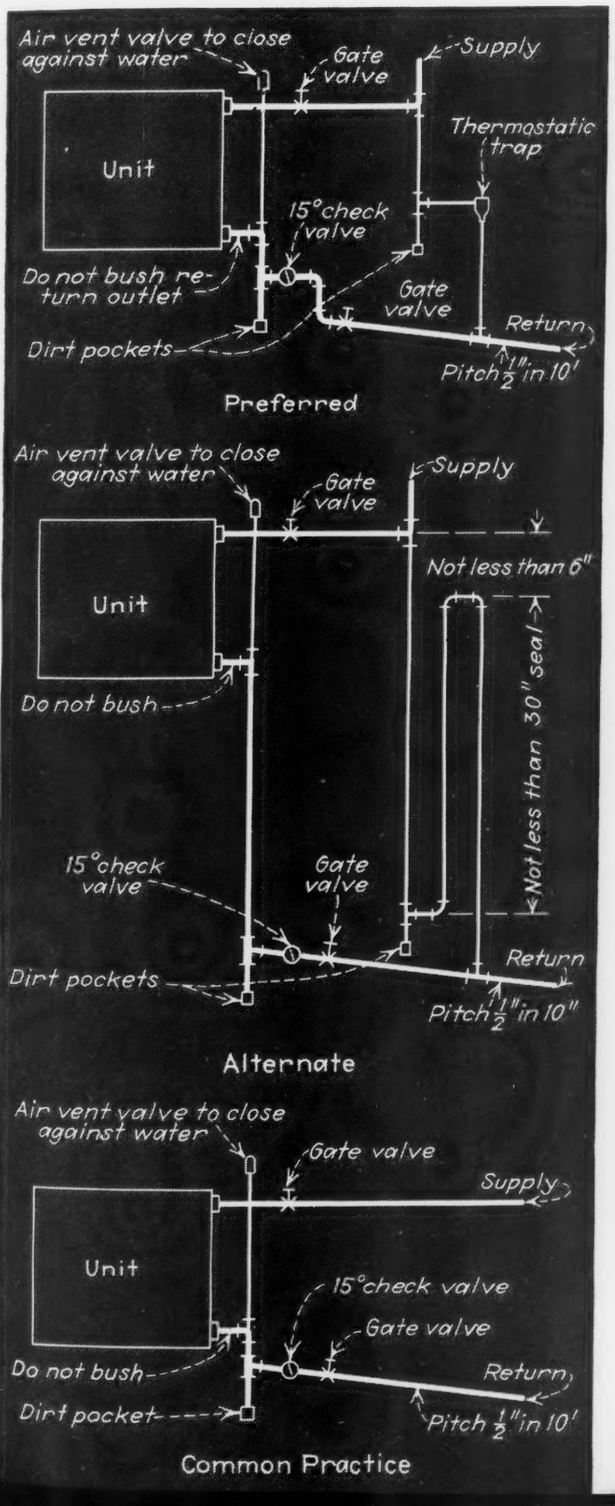
not less than 5 lb. steam pressure must be maintained on the coil at all times, and the steam supply should never be throttled, either manually or thermostatically.

Figures 1 to 4 illustrate piping diagrams for unit heaters. Three diagrams are shown for each system—preferred, alternate, and common practice. I recommend that only the preferred layouts be used.

The diagrams in Figure 1 apply to a low-pressure, closed, gravity system. In such a system the steam pressure is maintained at 15 lb. or below, and the entire system is at boiler pressure. Flow of condensate back to the boiler is caused by the static head of water above the boiler water line. Air in the piping system should be released at the unit by means of vent valves, preferably the type that closes against water. Heater units should always be placed at least 30 in. above the boiler water line.

Low-Pressure, Open Gravity System

For connection to a low-pressure, open, gravity system refer to Figure 2. With such systems the steam is maintained at 15 lb. or below, and the condensate returns to an open sump or receiver. Therefore, the condensate line is not at boiler pressure. The condensate is picked up from the sump or receiver by a pump and returned to the boiler by mechanical means. Air should be discharged preferably at the heater unit by means of a vent valve or open air vent. However, air is frequently discharged into the return main through a thermostatic trap or a combination float or bucket trap equipped with thermostatic air bypass, in which case the air must be



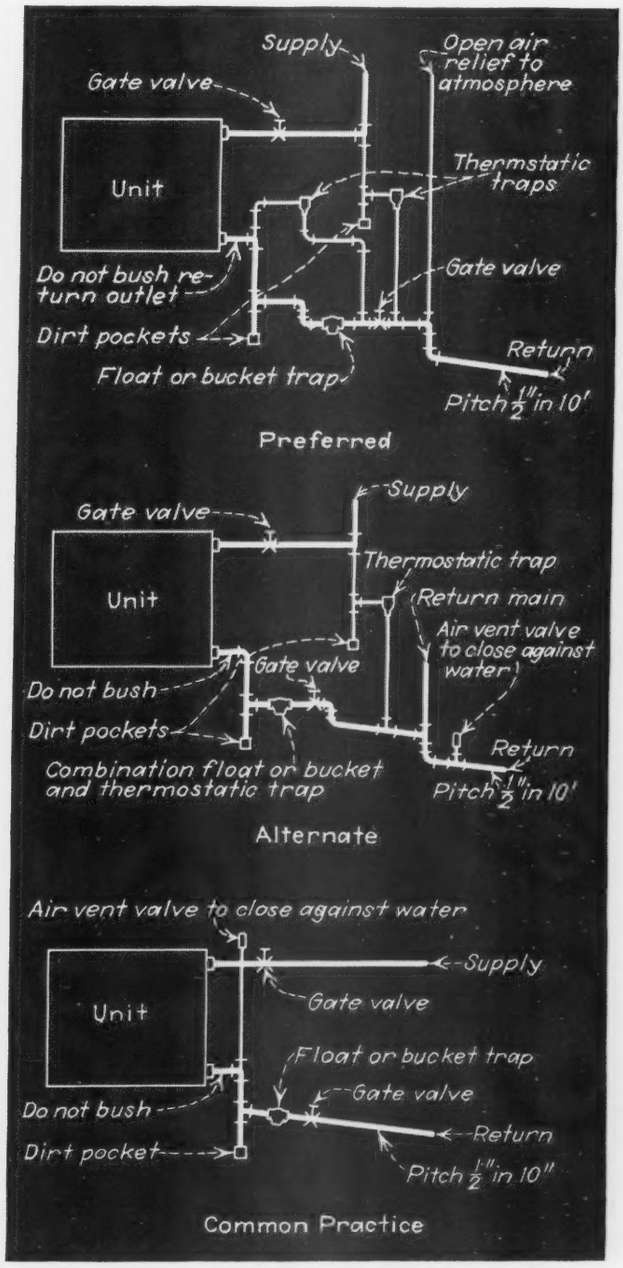


Figure 1 (left). Low-pressure, closed gravity system
Figure 2 (above). Low-pressure, open gravity system

vented either at the receiver or from the return main.

A low-pressure, vacuum system is one in which the steam pressure is maintained at 15 lb. or below and the condensate is returned to the boiler from the receiver under pressure by means of a pump which in turn maintains a vacuum in the return mains. Air is discharged from the unit heater through a thermostatic trap (or a combination bucket or float and thermostatic trap) into the condensate return line. It is then vented at the pump receiver. See Figure 3.

In Figure 4 are given the piping diagrams for connecting unit heaters to a high-pressure system.

A system is considered to be high pressure when steam pressure is maintained above 15 lb. Flow of condensate back to the boiler is caused by the static head of water in the return main above the boiler water line, through a boiler trap (never directly to the boiler). However, the condensate can be returned to an open sump or hot well and discharged therefrom to the boiler by means of a pump. This is probably the most common practice on high-pressure systems.

Discharging Air

Air should be discharged at the unit through a pet cock or high-pressure vent valve. Although this practice is not to be recommended on high-pressure systems, air is sometimes discharged through thermostatic traps into the return line, but it must be vented at the hot well. Overhead returns are possible with high-pressure steam systems.

Without an adequate steam supply, the best unit heat is badly handicapped. The boiler should, therefore, be sufficiently large to overcome ordinary line losses plus the accelerated load that exists after periods of shutdown. For example, a factory maintained at 60 deg. F. during the day will probably have a morning temperature of approximately 40 deg. F. Consequently, the boiler should be large enough to maintain its working pressure and supply the B.t.u. equivalent to the capacity of the units, based on air entering at 40 deg. F., plus the B.t.u. losses from the steam mains.

If the plant has been shut down for a longer period, room temperatures may be lower than 40 degrees.

Where the steam piping is covered, it is customary to figure the line losses as 25 per cent of the unit heater load. If the lines are not covered it will be necessary to compute these losses.

Figure 3. Low-pressure vacuum system

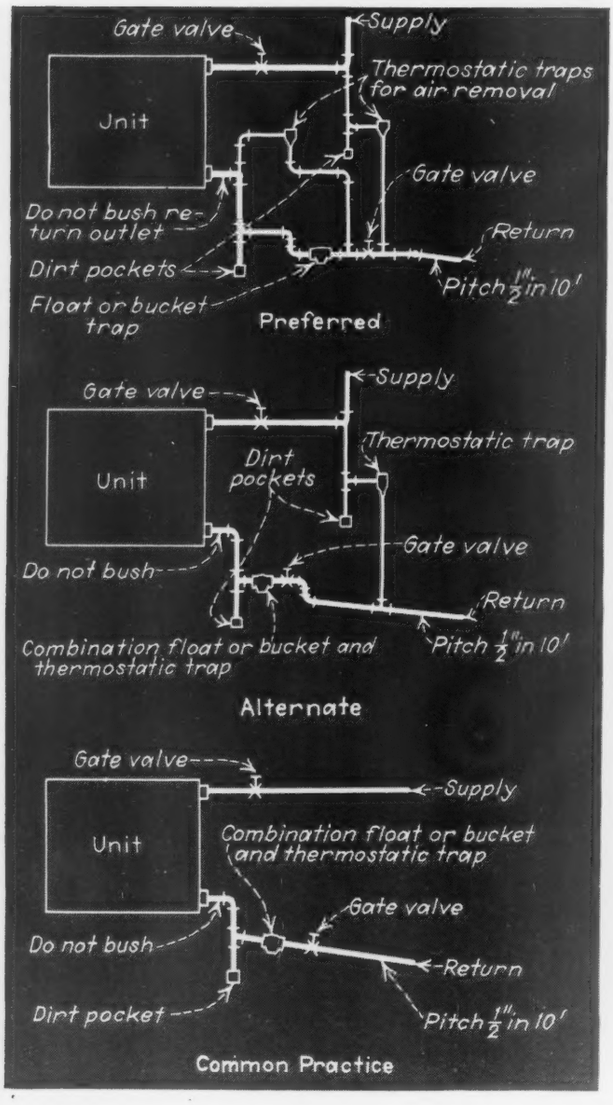
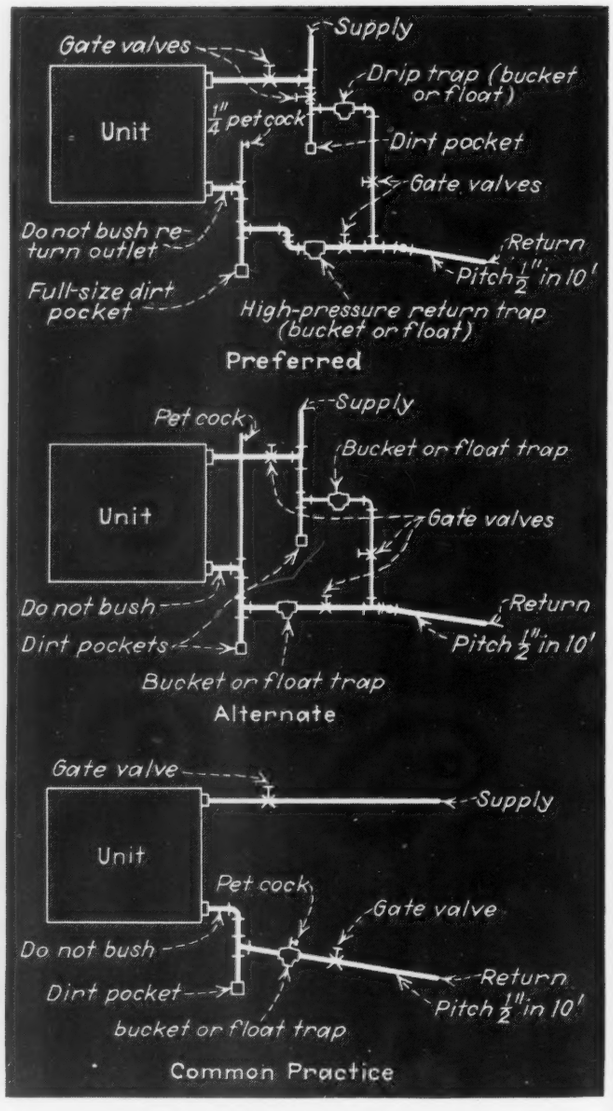


Figure 4. High-pressure system



When Wiring Your Plant

Layout and installation of high-voltage and primary systems present many problems that will cause trouble if not properly handled

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Anaconda Wire & Cable Company
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IN PREVIOUS ISSUES, starting in May, the electrical arrangement of circuits, types of cables suitable for different services, and other subjects were discussed. This article will deal with the physical arrangement of circuits and precautions that must be taken to insure the best results. High-voltage and primary systems will be treated separately, since they present individual problems.

With outdoor high-voltage systems, the problems are similar to those that confront an electric power company. Here, too, there may be high-voltage circuits coming in that must be carried across private property to the distribution substation.

Some Accepted Solutions

There is little to be said about this problem because the accepted solutions that have been worked out for it will be applied. It is necessary that sufficient attention be given in each case to required clearances between buildings, ground, and yard equipment; proper protection from lightning; selection of proper conductors; correct sags and spans; proper designs of supporting structures; and other features inherent in high-voltage transmission.

Give special attention to the insulators if they are exposed to steam, fumes, or various kinds of dust. Such cases are special and cannot be discussed in general terms.

Bear in mind that no matter who installs the job, all these details should be watched.

Cases will arise in which underground construction must be considered for carrying both high and low voltages across the property. This, too, is a special problem that cannot properly be discussed in general terms. Experience has shown that improperly designed duct banks for underground work will reduce the capacity of the cables therein to as low as 25 per cent or less, whereas properly designed duct banks will permit all the cables to operate at 100 per cent rating.

The choice between overhead or underground construction for voltages of 35 kv. and below should be made on the basis of an economic study for each case. Consider carefully the relative reliability of service afforded by the two types of construction.

Above 35 kv., bare conductors are usually employed. Overhead insulated cables should be limited, if possible, to 15-kv., three-phase rating, although there is occasional justification for a higher voltage. The higher the voltage, the more care is needed when cables are installed in the air, because of their exposure to sun and weather.

When overhead cables are used, a number of special problems usually must be solved, such as the possibility of corrosion of the messenger cable and hangers, location and type of supporting structures, and accessibility for repair and testing. When corrosive conditions exist, bronze messengers are considered to be very reliable.

With underground cables such problems arise as the possibility of electrolysis and corrosion of the lead sheath; proper grounding and bonding; draining of ducts; design of manholes; separation from sources of heat.

Job for an E. E.

Since all these problems are usually outside the range of industrial managers and engineers, they are merely mentioned. Their solution is decidedly a job for an electrical engineer with specific experience in power problems and an understanding of factory conditions and requirements.

Next in importance are the primary and secondary distribution circuits. There are many items that apply to both, and some salient facts are given here although it is realized that it is inadvisable to set down a definite prescription that any inexperienced man can follow blindly.

Such circuits are, unfortunately, often laid out in a haphazard manner, particularly when management tries to save on the cost of engineering and permits inexperienced persons to design the system. It is true that no matter how clumsy the arrangement, electrical energy somehow usually finds its way around. However, the fact that the plant is running without any particular trouble is no proof that improvement cannot be made to advantage.

There are several principles that ought to be kept in mind. The first is: *Specialized engineering knowledge and experience superimposed upon a knowledge of production requirements and the hazards inherent*

FIVE WIRING PRINCIPLES

1. Specialized engineering knowledge and experience superimposed upon a knowledge of production requirements and the hazards inherent in a given plant, must be the basis for planning the physical arrangement of circuits
2. The neatest-looking design is usually the best
3. Circuits should be so arranged that it is easy to trace them, and easy to find troubles and faults in them
4. In all cases avoid bottle necks
5. Install primaries with sufficient care and forethought to make them just as reliable as demanded by that part of the plant which they serve

in a given plant, must be the basis for planning the physical arrangement of circuits. And planned they must be. It would seem unnecessary to emphasize this fact, but a visit to a number of average plants will result in the conviction that only in a few has there been any planning at all—or if there was, it was done so many years ago that the original plan has been entirely outgrown or outmoded.

Another principle is: *The neatest-looking design is usually the best.* Good appearance is the first indication both of good engineering and economical design. Here is the place for the factory manager to exert his influence, insist on good appearance, and not be misled by claims that intricate electrical requirements require a clumsy, unsightly layout.

"Transparency"

Next in importance to good appearance, and hand-in-hand with it, is what might be called "transparency," which, of course, does not mean the use of glass conduits. It is defined by the third principle: *Circuits should be so arranged that it is easy to trace them, and easy to find troubles and faults in them.* If trouble does develop in a properly laid out circuit, the cause can and should be found quickly and power restored with minimum loss of production.

Easy accessibility of circuits is simply the result of planning and forethought. Briefly, it means having ducts, conduit, raceway, and open-wiring circuits arranged and numbered so that they may easily be traced; having labels on the circuits and switches in the wiring panels and pull boxes; large enough troughs so that the wires and cables can be followed through; records in the office to show what has been installed all over the plant; accurate drawings as a part of these records.

It is most important of all to have the wires and cables carried along the walls or up to the load centers in an orderly manner—never through the air, indoors, where they are always subject to damage. A good wiring job in a plant requires that all cables be inclosed unless the cables themselves are armored.

Open wiring at motor lead connections is not to be recommended. Many mills are discarding the fittings and attaching to the motor welded steel boxes which are large enough to accommodate a workman's hands when making the joints. Such boxes help to prevent outages and save time when a motor must be changed.

The fourth principle, and one of the most important is: *In all cases avoid "bottle necks."*

How Cable Is Usually Installed for Primary and Secondary Circuits

1. Insulated, lead-covered cable

A. Under ground
- (1) In fiber (incased in concrete), asbestos, or clay duct
- (2) In galvanized iron conduit
  - *a. Standard pipe size*
  - *b. Tubing size*
- (3) In aluminum conduit.
- (4) In copper-alloy conduit
- (5) Armored, buried directly in earth
- (6) Armored, submarine

B. Above ground
- (1) In metal conduit
  - *a. Steel, standard pipe size*
  - *b. Steel, tubing size*
  - *c. Aluminum*
  - *d. Copper alloy*
- (2) Suspended by messenger
  - *a. With bare sheath*
  - *b. Armored*
- (3) Clamped to walls and columns
  - *a. With bare sheath*
  - *b. Armored*

2. Insulated, braid-covered cables

A. In metal conduit, above ground
- (1) Steel, standard pipe size
- (2) Steel, tubing size
- (3) Aluminum
- (4) Copper alloy

B. In compartments or chutes, above ground

C. On insulators, exposed, indoors or out

D. In underground ducts when designed for that purpose.

E. On racks indoors

3. Bare wire and cable

A. On insulators
- (1) On poles
- (2) On wall brackets or roof supports
- (3) Inclosed in compartments, above ground

4. Non-metallic, armored, insulated cables

A. Under ground
- (1) In fiber, asbestos, or clay duct
- (2) Buried directly in earth

B. Above ground
- (1) Suspended by messenger
- (2) Clamped to walls and columns

When there are duplicate or triplicate main supply lines or branch circuits, two or more circuits serving the same load should not be in the same run, either underground or overhead. Neither should they be in the same splicing box. In extreme cases where separation is impossible, adequate fire protection should be provided to prevent one circuit from affecting another.

The accompanying table shows the usual methods of installing the different types of cable in both primary and secondary circuits.

As was mentioned in a previous article, primary distribution usually will be at 2,300, 6,600, or possibly 11,000 or 13,200 volts, from a substation or local power house to the various buildings and other load centers on the property.

Reliability

After the proper cable has been selected, the fifth principle to follow is: *Install primaries with sufficient care and forethought to make them just as reliable as demanded by that part of the plant which they serve.*

The same precautions required for high-voltage cables apply here, but the problems are usually not quite so complex.

Where atmospheric or other local conditions require it, lead cable frequently is used overhead, either armored, in metal conduit, on cleats, spools, racks, or in metal or concrete troughs. In all such installations, considerable attention should be given to neatness and clarity of arrangement. When any cable, whether lead-covered, armored, or of other construction, is run from building to building or from column to column, it should be carried on a messenger fitted with the proper hangers, unless the cable is sufficiently strong to carry its own load. It is important to make sure that the points of support are not so far apart that the concentrated weight of the cable will injure the insulation. This is the reason for putting hangers close together.

Cables installed outdoors, unless lead covered, should be protected with the proper coverings, saturants, and finishes. Where several cables must be carried together a conduit installation may be best, but this does not mean putting all cables in one conduit.

•

(The next article will discuss the layout and installation of secondary distribution circuits.—ED.)

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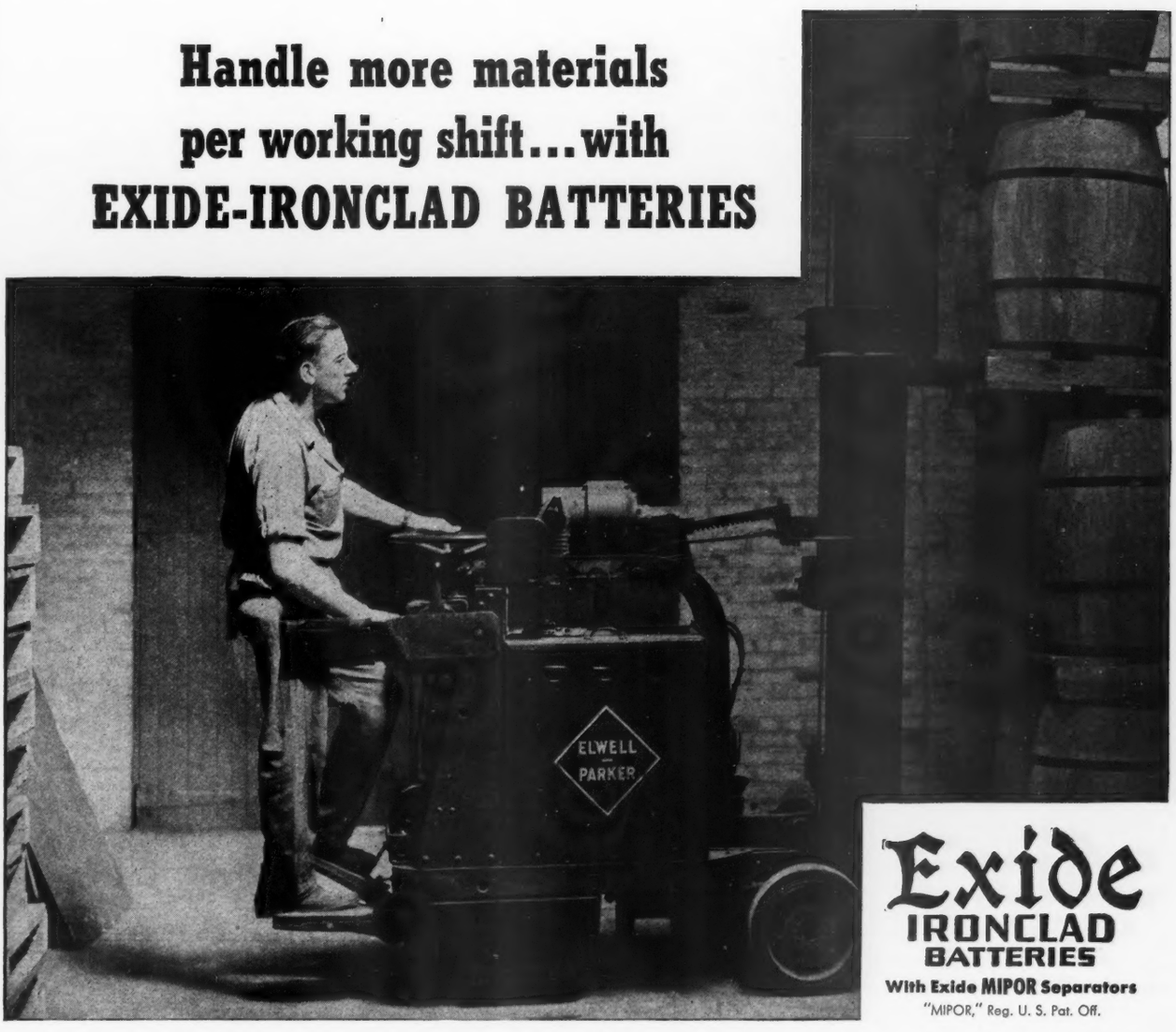

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and the editors will gladly tell you more about the things mentioned on this page

• BELT LACER, inexpensive, makes lacing a cinch. After inserting hook strips in magazine and belt between spiral-spring pressure jaws, all you do is tap the hooks into the belt with a hammer or squeeze them in with a vise. (10701)

• FOREMAN and apprentice training in foundries was topic of the recent American Foundrymen's Association convention. The papers are reprinted in a booklet. (10702)

• PLASTIC, claimed to wear better than metal on pump impellers, is highly inert, will resist anti-freeze and cleaning compounds, can be machined without impairing its water and chemical resistance. (10703)

• DESK LAMP, indirect type, is simple and good looking. Mushroom-shaped, light rays are directed against white-enameled inner surface of antique brass or polished chrome shade where they are reflected and diffused over the entire desk surface. (10704)

• BUSINESS MEN are interested in the administration of federal finances, especially in these years. They should read a booklet which contains a critical description of the existing system, then an analysis of two independent reports suggesting changes. (10705)

• FOR PACKING a lot of usefulness into a small space our vote goes to a gadget that contains within its 4 x 6 x 3-in. space an alphabetical file for business cards, dated tickler file, automatic perpetual calendar, and memo pad with sheets just the size for the tickler. (10706)

LOOKED FOR SO LONG, it's here at last—a small parts assembly rack for that motion-studied, circular workplace. Its removable bins are available in two sizes, the rack in four lengths. Bins even have a slight slant so that parts slide forward and keep front of trays full. (10724)

•ARE your conveyor and elevator belts receiving proper care? To check up you'll want to write for a 20-page belt maintenance manual. (10707)

• PROTECTIVE CLOTHING for welders is made in a new line which comprises coats, pants, sleeves, aprons, leggings, spats, and gloves, as well as goggles, hand shields, and helmets. Supplied in three materials—duck, asbestos, and chrome leather. (10708)

• CALL SYSTEM has speakers so sensitive they can be addressed from distances of 20 to 40 feet. Master station can call any one of 5 stations, or all 5 at once, and any station can reply to the master. (10709)

• STUCK so many times ourselves trying to take tacks from a box, we can't resist the temptation to tell of the box one manufacturer has devised, where the lid, hinged at the back, is lifted in front to uncover an opening through which the tacks are shaken out, one or more at at a time. No more pricked fingers. (10710)

• SALT TABLET DISPENSER provides a convenient means of supplying men working in hot locations with salt to ward off heat sickness. It gives one tablet at a time, is waterproof and dirtproof. Place for it is next to the drinking fountain. (10711)

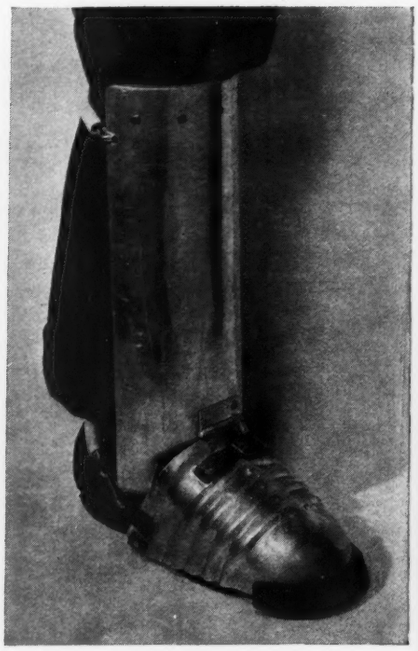
• BITUMINOUS COAL has had its biography written in a pamphlet describing its origin, methods employed to mine and prepare it, its early and present day uses. (10712)

• DOOR HOLDER, which doesn't attach to door, can hold door in any position. A small metal strip secured to two flutted rubber blocks is bent slightly, slipped under the door. The door is held securely. (10713)

• GUMMED PAPER of a new type will adhere to non-porous surfaces when moistened with water and does not require liquid adhesives. (10714)

• COLONIES, trade barriers, and the gold standard are important problems in world economy and politics, and are important to prosperity. Worth reading is a booklet which explores the problems. (10715)

• CORK PADS, cut in diameters from 1 to 14 in., solve the light machinery vibration problem. They slip easily under legs of pumps, fans, and the like. (10716)



LAST YEAR this foot guard was introduced and proved mighty popular. Now, improved with a silent toepiece and quick fastening attachments, it appears with an aluminum-alloy shin guard added to it. Complete guard is easy to put on, permits wearer free foot and leg action. (10723)

• MAKE your own blackboards for foreman training and safety meetings by spraying a new lacquer on wood, wallboard, or cardboard. It gives a slatelike surface which takes chalk marks without any trouble. (10717)

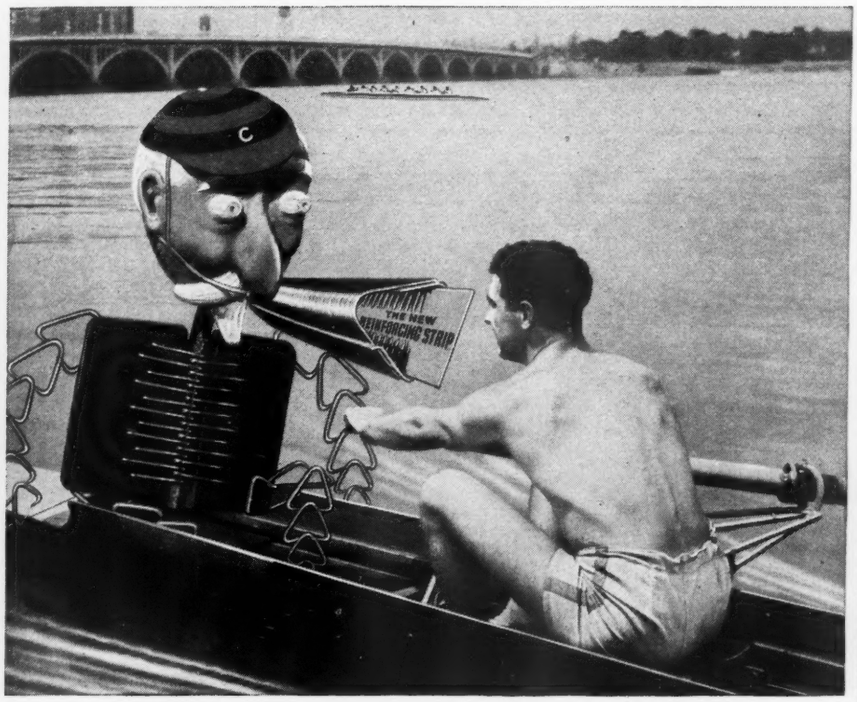
• HEAT—the story of man's age-old struggle to control this powerful force of nature is contained in a booklet which should tell you a lot you didn't know before. (10718)

• "BI-OPTICAL" PYROMETER measures black body and actual temperatures simultaneously. Has scale range of 900-1,900 deg. C. or 1,700-3,500 deg. F. (10719)

• SPRAY PAINTING UNIT, air-operated and portable, is a baby in size but does a man-size job. (10720)

• WITH more and more attention being given to air conditioning and ventilation, every plant should have a copy of the fire regulations for installation of air conditioning, warm air heating, air cooling, and ventilating systems around. (10721)

• RUBBER CEMENTS, four of them, can be applied without vulcanizing to rubber, glass, metal, wood, leather, paper. They differ from one another in drying speed and color, and can be used under wide temperature fluctuations. (10722)



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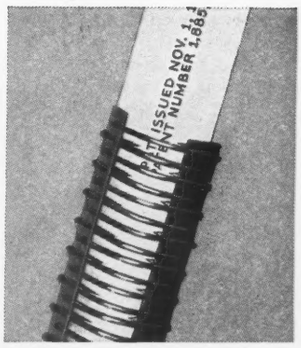
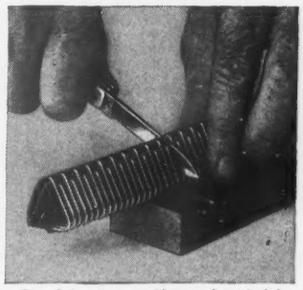
Clipper
BELT LACING EQUIPMENT



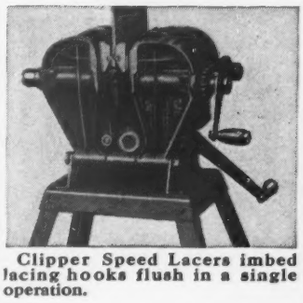
For *greater convenience* and *added economy* order Clipper Belt Lacing Hooks with the NEW Reinforcing Strip.



Card is cut easily and quickly with a knife—without waste.

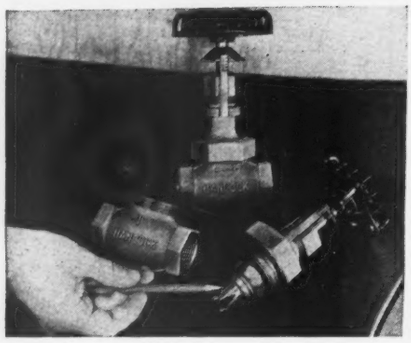
No part of the carding remains to fly off or prevent proper imbedding.

The REINFORCING STRIP strengthens the carding—helps hold the hooks in perfect alignment—and preserves the unused portion of the card of hooks for future lacings (against even rough handling or carelessness).



Clipper Speed Lacers imbed lacing hooks flush in a single operation.

What's New in Equipment

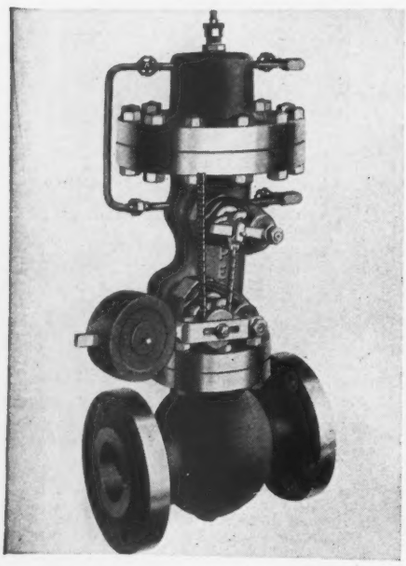


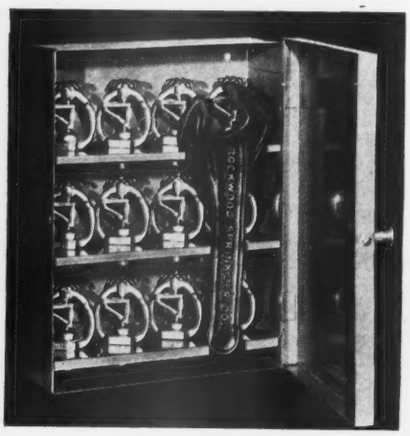
Valves

Redesigned line of bronze Flocontrol valves. Retain basic proportional flow or straight-line flow characteristics of the original valve, but have hard stainless steel valve seats and disks for increased wear resistance. Have a new body of union bonnet type instead of the inside screw bonnet originally used. Used for all sorts of temperature control for gas-fired, oil-fired, or steam-heated processes; for proportional blending of liquids, water softening systems, oil burner lines, continuous boiler blow-down and many other uses. Hancock Valve Division, Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Feed Water Regulator

"Copes Flowmatic Regulator" is a two-element, steam-flow type of boiler feed water regulator. It feeds boiler according to rate of steam flow and provides water level characteristics that give best operating results. A higher water level can be provided on heavy loads than on light, or a practically constant level can be maintained for all ratings. It has two control elements. The steam flow controller measures the rate of steam flow by taking the pressure drop through the superheater. The water level thermostat, with tension-type expansion tube, responds instantly to changes in the boiler water level. These two elements are connected mechanically to the feed water control valve in such a way that the valve is positioned by the resultant of the two forces. May be direct-operated or hydraulically operated. May be installed in any position in the boiler feed line. Furnished in all pressure standards from 250 lb. upward. Valves are furnished in 2- to 6-in. sizes. Northern Equipment Co., Erie, Pa.



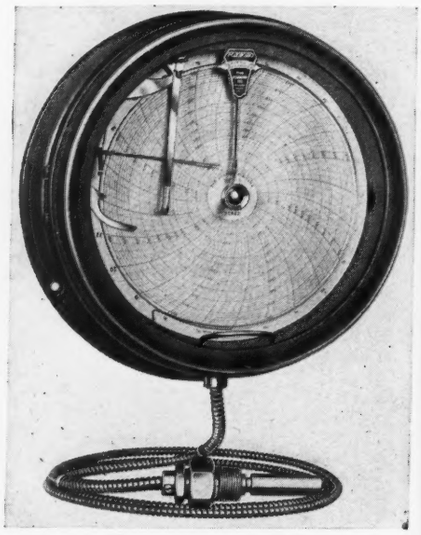


Sprinkler Head Cabinet

Emergency sprinkler head cabinet provides a place to store extra sprinkler heads for replacing those opened by fire or broken accidentally. It places heads where they can be found readily and makes it obvious when additional heads should be ordered. It protects heads from injury, breakage, or the accumulation of dirt. The cabinet is of steel construction with all welded joints; size 11¼ x 8¾ x 3 in. Individual mounting spaces are provided for twelve heads and a special sprinkler-head wrench. The cabinet is finished both inside and out in bright red enamel. Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.

Thermometers

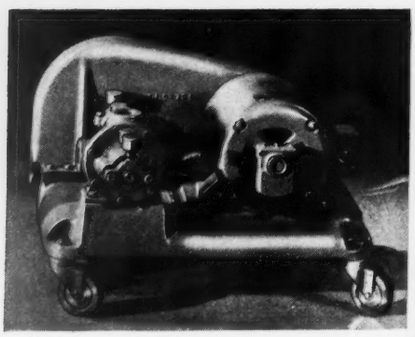
"Mono-Therm" indicating and recording thermometers employ an improved thermal system which provides a complete permanent seal for actuating medium. Entire system is either welded or braised in such a way that it becomes an integral piece of metal. This type of construction is being applied to the company's thermometers of the vapor-pressure, gas-filled and liquid-filled type. Available with the thermometers is an over-range protection. The liquid-



filled instrument can be protected against over-range up to a maximum of 500 deg. F. The gas-filled instrument can be protected against an over-range of 100 per cent up to a maximum of 1,000 deg. F. The vapor-pressure type can be protected for a 100 per cent over-range to the breakdown point of the actuating medium. The Foxboro Co., Foxboro, Mass.

Pump

Portable rotary pump is offered in two sizes, with capacities of 10 and 20 gal. per min. Design is such as to provide for automatic take-up for wear. Mounted on free-swinging casters making it an easy job to move the outfit from one job to another. Can also be furnished without casters where permanent installation is required. The pump can be driven from the lighting circuit, can be used for pumping practically any liquid of any viscosity. It is positive in displacement, designed for high-suction lifts, and needs no priming. Blackmer Pump Co., Grand Rapids, Mich.



Hand Truck

Style 84-P hand truck for handling rolls of paper up to 36 in. in diameter and 83 in. in length. It is made of steel and will carry ton loads. Has hinged nose and ad-

BOTH ARE INDISPENSABLE

POWER RANGE

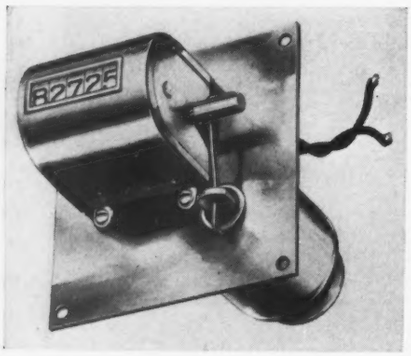
Every correctly designed bolted assembly *must* include *Helical* Spring Washers . . . *adequate both in range and power* to keep parts *tight*.

SPRING WASHER INDUSTRY

616 WRIGLEY BLDG., CHICAGO, ILL.

ONLY A HELICAL SPRING WASHER HAS ADEQUATE RANGE OF *Live Action*

justable running gear making it possible for two men to maneuver large loads easily and safely. Available with heavy-duty, rubber-tired wheels or with heavy-duty, pressed-steel wheels. The American Pulley Co., 4200 Wissahickon Ave., Philadelphia.

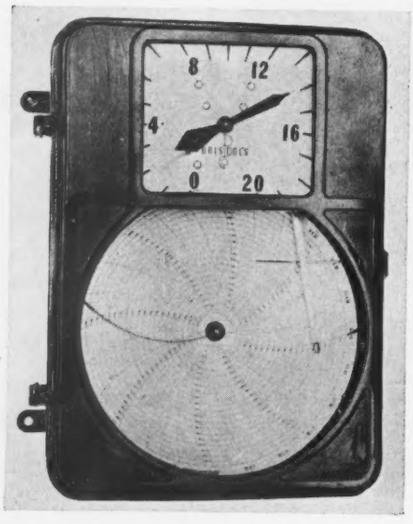


Counter

Line of electrically operated counters. Counter is compact, measuring 1⅞ x 1½ x 1¾ in. and is mounted on a plate 2⅞ in. square. Operating relay is attached below the base plate and extends 1⅞ in. below the surface. Equipped with large, legible number wheels and black figures on white background. Five number wheels give a capacity of 99,999. Case is of steel. Type SEC. Production Instrument Co., 1325 South Wabash Ave., Chicago.

Pyrometer

"Indicating Recording Pyrometer" is the name of the new potentiometer pyrometer for recording and indicating thermocouple temperatures. It provides for direct marking on a 12-in. round chart and scale indication on a large dial. It is said to be rugged and not affected by excessive vibration. Operating mechanism consists of galvanometer, relay unit, standardizing unit, a "Power Pack," and the potentiometer or recording and indicating units. The pen arm is actuated through relay switches in small steps at a rate depending upon rate change in temperature at the thermocouple. No lubrication is required. Cold-junction compensator is automatic. Available as a recorder, indicator, recorder with indicating scale, recorder controller, and as a recorder controller with indicating scale. Controllers are of either the pneumatic or electric type. The Bristol Co., Waterbury, Conn.

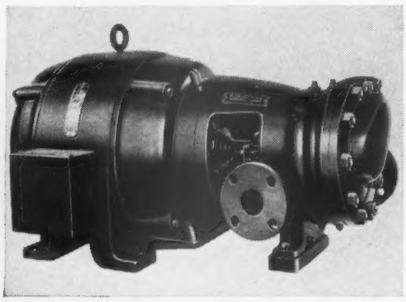


Temperature Gage

Dial-and-pointer-type gage has "coils-within-coils" design for the bimetal temperature-sensitive element. This element is sheathed within a stainless steel stem. Circular dial case, 3 in. in diameter, is mounted at right angles to and at top of the stem. Three models are available: (1) for dryers, having range of 50-500 deg. F.; (2) for bakery ovens, having range of 150-750 deg. F.; (3) for industrial ovens, having range of 200-1,000 deg. F. Anodized aluminum dial face is easy to read. Construction is said to be rugged and durable, and over-temperatures are said not to harm the gage or affect its accuracy. Weston Electrical Instrument Corp., Newark, N. J.

Pump

A two-stage centrifugal pump with impeller mounted directly on the shaft of splash-proof motor is said to operate against heads up to 500 ft. It is adapted for all classes of general pumping service with liquids low in viscosity and free from excessive foreign matter. Because of its compact design, it is advantageous where space is limited. The pump is complete in itself and can be mounted in any horizontal, vertical, or angular position. Two rugged ball bearings take all of the radial and unbalanced thrust loads. Impellers for the two stages are placed back to back, compensating thrust. Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago.



Unit Heaters

Line of gas-fired unit heaters known as the "Janitrol" line. Consists of seven sizes ranging from 45,000 to 200,000 B.t.u. hourly input. These heaters are an improved line over other heaters of the "Janitrol" type. Objectionable operating noises are said to have been overcome. The heaters are styled to meet the modern trend with offset front panel and graceful rounded corners. Casing finish is blue crackle baked enamel and air louvers are of aluminum. Surface Combustion Corp., Toledo, Ohio.

Aluminum Reflectors

"Alzak" aluminum reflectors for lighting low bay areas. Called "Ivanhoe." Accurate control of reflected light and widespread distribution are claimed for them. Made of heavy-gage aluminum, and are said to be rugged. Made in a complete line of sizes with standard-type holders. The Miller Co., Meriden, Conn.

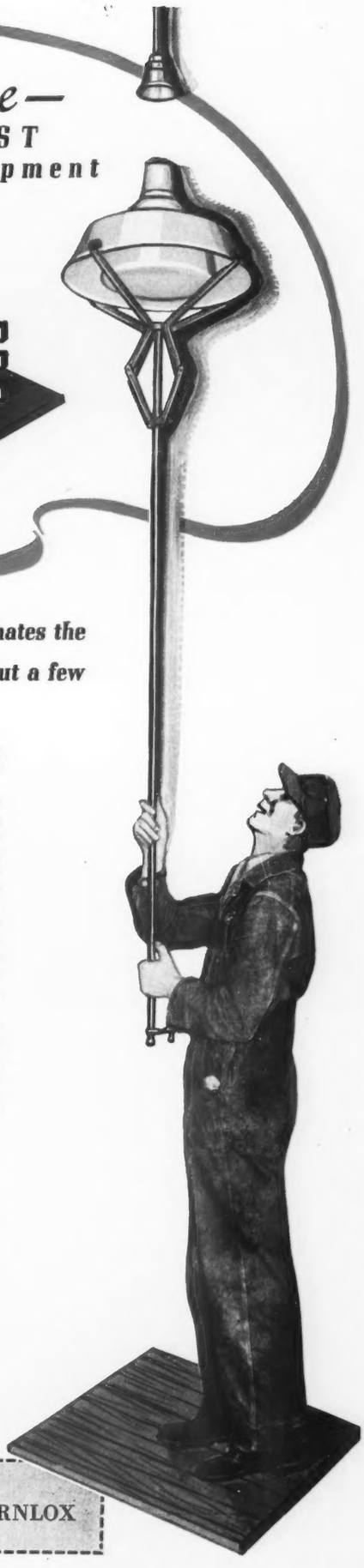
Truck

"Grab-It" truck provides easy transportation of heavy kegs, barrels, tubs, and similar containers. The device automatically grabs the container; tilting the handle raises the container to transporting position and automatically releases it at destination when handle is tilted forward. This is accomplished without turning the container over, and without the operator touching the container. Con-

Another Advance—

in SAFER and LOWER COST Maintenance of Lighting Equipment

BENJAMIN FLOOR-SERVICE TURNLOX



A New Optional Turnlox Feature which eliminates the use of the hazardous, time-wasting ladder in many locations. Costs but a few cents more than regular Turnlox Equipment.

Turnlox and now Floor-Service Turnlox! Two Benjamin developments, each with a definite place and purpose in the solution of the all-important maintenance problem.

Dirty reflectors and inefficient lamps can waste up to 80% of their rated efficiency. Frequent cleaning and inspection is therefore just as important to Right Lighting as the installation of the right type of lighting reflectors.

To simplify maintenance, minimize production interruptions, and reduce maintenance costs, Benjamin originated the Turnlox hood construction. Turnlox made it possible to remove the reflector and lamp as one unit for easy cleaning *on the floor.*

Now comes the Benjamin Floor-Service Turnlox to make possible the safe and easy removal of the reflector and the lamp as one unit *from the floor.* All of the familiar Turnlox advantages are retained. Floor-Service Turnlox units differ only in their bell mouthed hood construction.

Standing safely on the floor, it takes but a moment for the maintenance man to clamp the Benjamin Floor-Service Reflector Changer to the reflector rim. He then exerts a slight upward pressure on the changer shaft and turns left a quarter turn to remove or right to replace.

Quicker and easier, Benjamin Floor-Service Turnlox thus lowers maintenance costs, eliminates production interruptions and accident hazards in the servicing of reflectors mounted up to a height of eighteen feet.

Complete details and information concerning Turnlox reflectors available with the optional Floor-Service feature at a very slight increased cost may be had by writing or returning coupon to Benjamin Electric Mfg. Co., Des Plaines, Illinois.

Benjamin Turnlox Reflectors available with the Optional Floor-Service Feature—
Turnlox RLM Dome Reflectors . . Turnlox Flat Cone Reflectors . . Turnlox Shallow Dome Reflectors . . Turnlox RLM Bowl Reflectors . . Turnlox Glassteel Diffusers . . Turnlox "Silvered Lamp" Diffusers . . Daylight Globe "Turnlox" Glassteel Diffusers . .
Also available are several of the Benjamin standard Mercury Lamp reflectors. Present Turnlox Installations of above reflectors may be converted into Floor-Service Equipment by a simple change in reflector hood.

The UNSUSPECTED ROBBER

in industry is inadequate lighting. Its elimination results in (1) Conservation of workers' eyesight; (2) Increased personal efficiency and health of employees; (3) Fewer Accidents; (4) Less Rejects and Spoilage; (5) Reduced Labor Turnover; (6) Smoother, more efficient operation.

Benjamin Electric Mfg. Co.
Des Plaines, Illinois

Send complete catalog details on the new Benjamin FLOOR-SERVICE TURNLOX

(Write your name and address in margin below.)

tainers from 50 to 700 lb. can be handled. The truck is made in four models, each one adjustable to three different sizes of containers by altering the position of the grab members. Wash Co., 720 Bowman Ave., Danville, Ill.

Counter

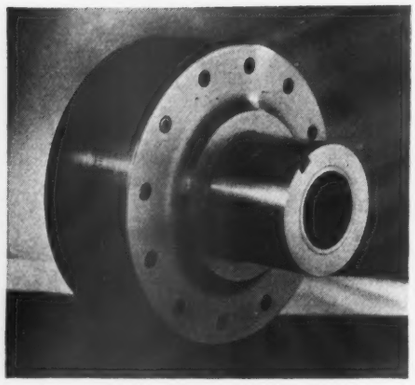
Type MC-3-W mechanical counter of heavy-duty design is especially adapted to counting coil winding and similar operations. Has six large legible number wheels and is arranged for shaft drive. Has reset knob which returns all number wheels to zero with one revolution of the reset. Frame and case are die-cast of special alloy and are designed for convenient mounting. Dimensions: 3⅝ x 2⅝ x 1¾ in. Four mounting holes 3/16 in. in diameter are spaced 1¼ x 3⅛ in. Production Instrument Co., 1325 South Wabash Ave., Chicago.

pH Meter

Model 3 pH Electrometer is rugged and portable. The glass electrodes are factory-sealed, requiring no attention, and are mechanically protected from accidental breakage. Scale reads directly in pH units and can be read to 0.02 pH and the overall accuracy is claimed to be 0.05 pH. Determinations require approximately one minute, following initial calibration. For extreme precision, or when hot or cold solutions are to be examined, there is an automatic temperature compensator which is optional equipment. Also optional is a double, direct-reading scale and a special electrode for use where oxidation-reduction potentials may be significant. Coleman Electric Co., Inc., 296 Madison St., Maywood, Ill.

Clutch

Hilliard over-running clutch transmits power to operating cycle of a production machine, and automatically disengages when the speed of a driven member exceeds that of the driver. It automatically disconnects and idles until power is again applied. Unit is also used in dual drives



to protect the primer mover which is not in immediate use and to transmit power from the other. It is also used to control two-speed drives. It provides an excellent ratchet application capable of infinite adjustments, and a positive backstop for conveyors, elevators, etc. The Hilliard Corp., Elmira, N. Y.

Welders

Line of a.c. portable arc welders employ a circuit that provides a stable, non-blasting arc without spatter loss. May be used for fillet, horizontal, vertical or overhead welding and can be used for welding from

22-gage sheet metal to heavy castings. Designed for use on 220 or 440 volts, 60 cycles. Made in sizes from 15 up to 250 amp., for use with from 1/16 to ¼ in. welding rod. Pier Equipment Mfg. Co., 556 Cross St., Benton Harbor, Mich.

Bearing

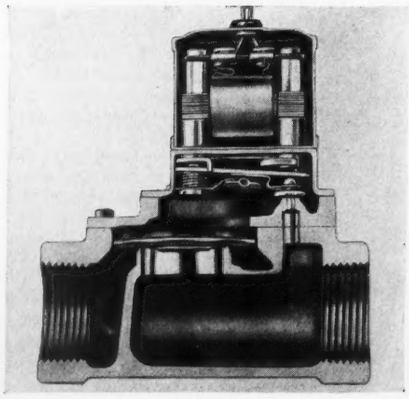
Oil film bearing in two types. Medium-type, 300 Series, cylindrical bearings are for radial loads, permitting axial float or expansion of the shaft—the lateral movement taking place within the oil film virtually without resistance. Second is medium-type, 1300 Series, spherical or self-aligning for thrust or location bearings in order to control the lateral position of the shaft as well as carry the radial load. In both types the outer members or races are locked in a lateral position in the housing. The usual installation requires one cylindrical and one spherical bearing. It is said that these bearings, properly installed in suitable housings, adequately sealed, and with ample oil capacity, will run continuously for one year on a single filling of oil. The Fast Bearing Co., Hampden Ave. and 23rd St., Baltimore.

Lacquer

"Durheat" lacquer is designed to withstand temperatures up to 300 deg. F. It is clear and air-drying, is said to retain flexibility, color, and adhesion. Maas & Waldstein Co., 420 Lexington Ave., New York.

Gas Valve

"Magnetic Gas Valve" is suitable for every type of gas-burning boiler or furnace. It can also be used with gas-fired humidifying equipment. Operates on 6-volt current without hum or noise. In case of need for servicing or replacement, entire electrical mechanism and moving parts can be removed without taking valve from the line. There is a small disk which floats loosely in the valve chamber. In the closed position, incoming gas leaks through the clearance around the circumference of the disk, filling up the chamber with gas at line pressure. As the gas cannot escape through the bleeder the pressure holds the disk firmly on its seat. When the control instrument lifts the bleeder valve the pressure above the disk is immediately released to the downstream side. The incoming gas then lifts the floating disk to the top of the chamber and as long as the bleeder valve is open it is held up. The main valve body is bronze, the floating disk is aluminum, and the valve seat on the floating valve, as well as the bleeder valve, is kid leather.

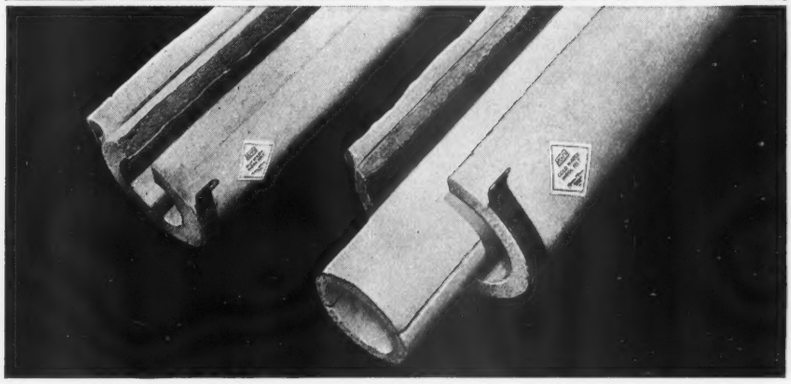


Operation can be at 110 or 220 volts through specially designed transformers. Julien P. Friez & Sons, Inc., Baltimore.

Electrodes

Coated electrodes for a.c. welding are known as "Crucible-Weld." They are available in sizes from $\frac{3}{32}$ to $\frac{5}{16}$ in. in diameter and are made in two grades of Black and Brown. In addition, a special $\frac{1}{16}$-in. electrode is available for use with very low current. Characteristics claimed are arc stability, low spatter loss, high tensile strength, and high ductility of de-

Economical for hot or cold water lines



K&M WOOL FELT INSULATION

One of the most moderately-priced *efficient* insulators you can use for hot or cold water lines is K & M Wool Felt. For cold water service, it is made of successive layers of flat wool felt, not creped, with an inner lining of waterproofed felt. For temperatures up to 212° F. it is made of successive layers of flat wool felt, not creped, with an inner lining of asbestos paper.

K & M Wool Felt in these two forms, like all K & M products, offers unusual durability, uniformity and physical properties. More than 60 years' experience with insulation materials stands behind them. The K&M line is complete, priced right, and specialized for the needs of each plant.

Send for information

"Featherweight" 85% Magnesia Pipe Insulation, Blocks and Lagging • Asbestos Pipe Insulation in sections • Asbestos Insulation in sheets and blocks • Asbestos Insulating Cements • Asbestos Packings: rope, cord and sheet • Asbestos Gaskets, Gasket Tapes and Cloth • Friction Materials • Refractory Cements, dry and plastic • Asbestos-Cement Sheets in corrugated and flat form.

Underline the products on which you want full information and mail this coupon today.

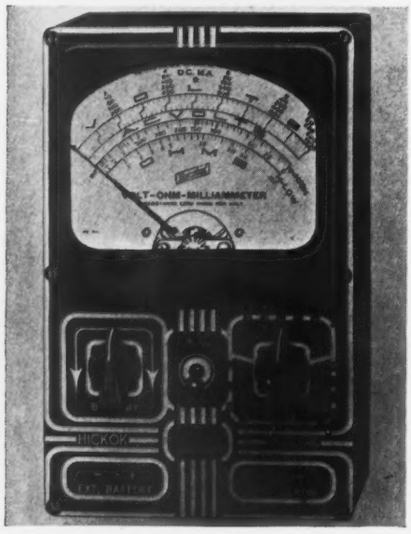
Name_____

Name of Firm_____

Address_____ 6-7

KEASBEY & MATTISON COMPANY AMBLER, PENNA.

posit. The Black electrodes are suitable for down hand butt welding because of their high melting rate and ability to operate at high current values with low spatter loss. The Brown electrodes are recommended for all general purpose work, horizonal, vertical, and overhead. They are especially adapted for fillets, single or multiple pass. Both electrodes operate on open-circuit welder voltages as low as 50 volts. Westinghouse Electric & Mfg. Co., East Pittsburgh.

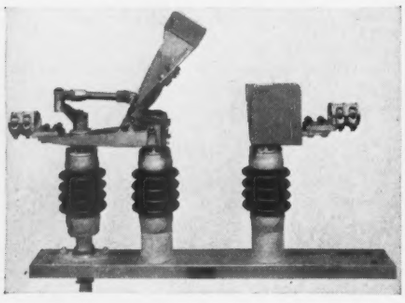


Volt-Ohm-Milliameter

Model 4955-S volt-ohm-milliammeter is for general circuit testing on both a.c. and d.c. circuits. Has high-sensitivity, 350 microampere movement. Rotary switch eliminates jacks. Contact resistance does not affect readings. Scale ranges are: a.c. volts, 0-10, 0-50, 0-250, 0-500 and 0-1,000; d. c. volts the same. Ohms, 0.05-30, 0.5-10,000, 50 ohms to 1 megohm, 500 ohms to 10 megohms. D.C. milliamperes, 0-1, 0-5, 0-50, 0-500. Resistor built to read 10 megohms with external battery. The a.c. voltmeter is usable as an output meter, using same scale as a.c. volts. Adjustment can be made for changes in rectifier efficiency. Has 4-in. scale length, plastic panel, steel case measuring 7 x 3½ x 4¼ in. The Hickok Electrical Instrument Co., Cleveland.

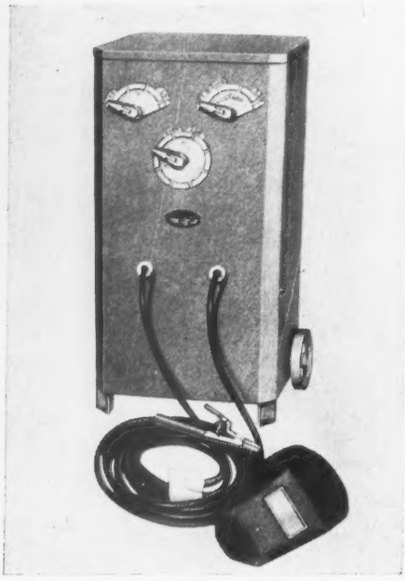
Switches

Three-pole, 15-kv., 1,200-amp. manual- and motor-operated disconnecting switch for inverted mounting. Type "FMB-139." The two fixed and the one rotating insulators are of the post construction with flashover values of 85 kv. dry, 50 kv. wet. Rotating insulator is equipped with ball bearings. The blade first raises to a parallel position, then changes to a lateral movement and enters the fixed full floating contact. With this parallelogram arrangement the switch operates without subjecting the insulator parts to shocks or jars. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.



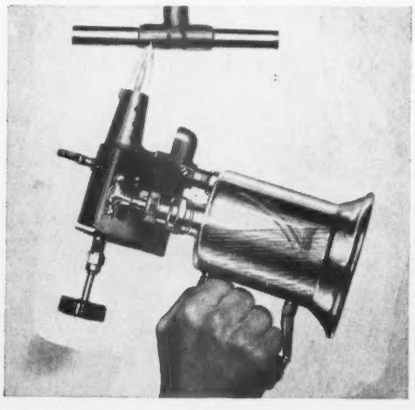
Welder

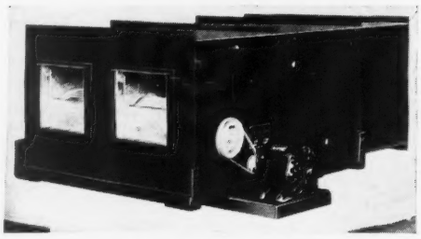
"Dual Control" a.c. welder has separate voltage and amperage controls, enabling operator to select most desirable voltage for amperage used on any job. It is compactly built and heavily constructed for hard usage. Is built in three sizes with current range from 10 amp. to maximum output that makes possible welding of sheet metal or heavy metal. It is equipped with wheels and a handle to make it portable. All three sizes have same cabinet dimensions and vary in weight from 235 lb. to 350 lb. Furnished standard for 220 volts. Miller Electric Mfg. Co., Appleton, Wis.



Torch

"Midget-Flame" Torch is designed for work on copper tubing and fittings. Has a small pointed flame 5/8 in. in diameter by 1¾ in. long at reduced flame. When opened wide the flame is 5 in. long. Uses gasoline, but curved internal fuel feed pipe and heavy wicking allow torch to burn in any position. Burner is a two-piece casting of alloy bronze. Jet block is renewable when worn, and the jet cleaner pin is replaceable. Clayton & Lambert Mfg. Co., French Road and Madola, Detroit.



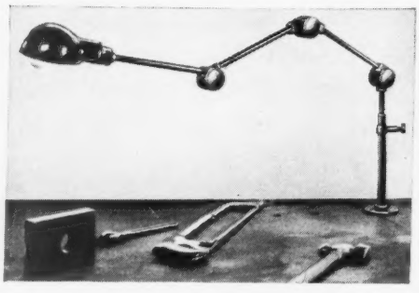


Air Conditioning Unit

"Multitherm" air conditioning unit is cabinet-type, self-contained. It cools, dehumidifies, heats, humidifies, and cleans. It can be made completely automatic. Regulated by room thermostat and humidistat. It is quiet in operation and can be suspended from the ceiling or mounted on a platform or on the floor. Can be used either with or without duct work. It can be operated entirely with recirculated air, or an inlet connection can be provided to utilize the volume of outside air as desired. Fan bearings are furnished with an oiling device which makes possible complete lubrication from one point outside the cabinet. Cooling and heating coils are copper tubes with copper or aluminum fins. Humidifier is of the spray type, using hot water. Cabinet is of galvanized steel. Clarage Fan Co., Kalamazoo, Mich.

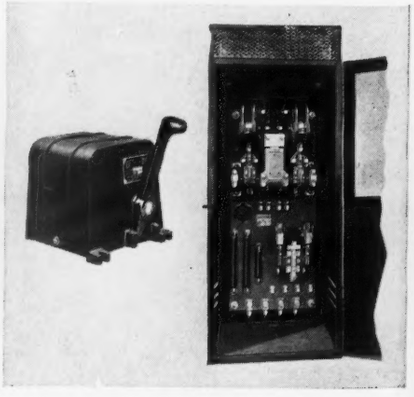
Lighting Fixture

Bench model of "WesCrel" light is for use on bench or machine. Each of the three joints used has a 360-deg. swing and is said to be dust, vapor, and explosion proof. There are no exposed wires on the light. There is a thumbscrew on the mounting stand to hold the lamp in any position. Finish is green enamel. Michigan Bumper Corp., Specialty Division, 2667 East Grand Blvd., Detroit.



Magnet Controller

Automatic-discharge magnet controller is quickly adjustable and uses a small two-position master switch with positions marked "lift" and "drop." The quick release of the load is obtained by plugging the



DON'T MISS THE BOAT!

● Don't miss the boat by starting too late. Get there on time on your maintenance and repair costs by arranging for the proper lubrication of your plant well in advance of your contract year.

Perhaps your plant is properly lubricated now—perhaps it isn't. Why not find out by having a Pure Oil Industrial Engineer make a scientific check over of your plant and give you a survey of his findings?

"Don't miss the boat!"

• • •

Comprising Pure Oil's Three Point Service is: 1) Selected Crude, 2) Skillful Refining and 3) Scientific Application.

THREE POINT SERVICE — PURE — THE PURE OIL COMPANY, U.S.A.

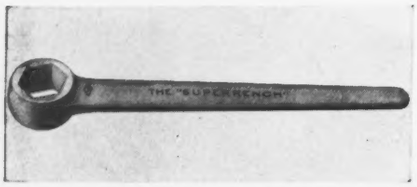
THE PURE OIL CO.

U. S. A.

PRODUCERS, REFINERS, MARKETERS OF A COMPLETE LINE OF PETROLEUM PRODUCTS

magnet with the proper value of current in the reverse direction and then the magnet is disconnected from the line automatically as the load is released. With this control it is possible to vary the value of plugging current which is allowed to flow. If the line voltage changes, or the operator switches to a different class of material, or uses a different size of magnet, a slight turn of the rheostat dial on this controller provides the proper plugging current for a quick drop under the new conditions. Wound-on-edge discharge resistors, coated with vitreous enamel, are mounted in a ventilated inclosure on top of the cabinet. The controller is designed for use with any single lifting magnet up to 65 in. in diameter. The Electric Controller & Mfg. Co., 2696 East 79th St., Cleveland.

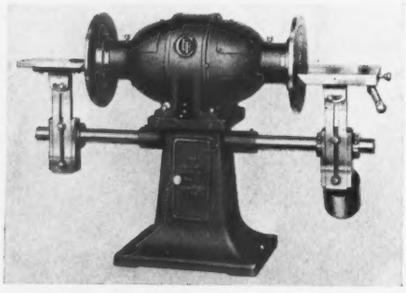
Wrenches



Heavy pattern wrenches are designed for severe service. The heads are approximately the same thickness as the nuts they serve. Drop-forged in two lines—carbon steel wrenches and chrome-molybdenum "Superrenches." Openings range from 1¼ to 3⅛ in. Carbon wrenches are finished in black enamel with bright heads. "Superrenches" are chrome-plated with faces of heads buffed bright. J. H. Williams & Co., 75 Spring St., New York.

Grinder

Several sizes of disk grinders have been added to the company's line. They may be had in double-end-disk type or with disk on one end and a conventional grinding wheel and wheel guard on the other side. The disks are of steel accurately machined and balanced. The spindle is of nickel steel dynamically balanced and mounted on extra large ball bearings with provision for both radial and thrust loads. The steel disks may be had for either glueing on abrasive disks or properly drilled for mounting steel-back abrasive disks. The motor is fully inclosed type with magnetic starter, with both overload and no-voltage protection and pushbutton control. The Cincinnati Electrical Tool Co., Cincinnati.



Switchboard Instruments

Miniature rectangular switchboard instruments are made as frequency meters, polyphase wattmeters, single-phase wattmeters, ammeters, voltmeters. Mount is flush in round hole of 3½ in. diameter. Instrument flange projects ½ in. in front

of panel. The a.c. instruments can be supplied with illuminated dials. Front of instrument has full open face for easy reading with a scale over 3¾ in. long. Case and front are made from molded phenolic material. The Hickok Electrical Instrument Co., Cleveland.

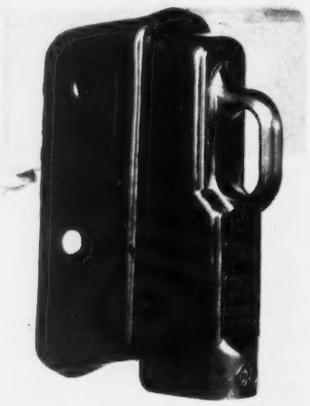
Welding Helmet

Chrome leather welding helmet is designed for electric welding in tight places where the conventional type of shield requires too much space. Made of chrome leather and especially constructed vulcanized fibre headgear. Headgear is form fitting and adjustable to various head sizes. Outer section of the composition

glass holder flips up instantly for weld inspection, actuated by springs which are inclosed in the hinge joints. This outer section is a shaded glass available in two qualities, one for operations up to 200 amp., the other for operations over 200 amp. Clear glass in the stationary section of the glass holder remains before the eyes when the front is raised. Industrial Products Co., 800 West Somerset St., Philadelphia.

Reclosing Fuse Cutout

Porcelain-housed fuse cutout has reclosing mechanism in the door. Is rated at 50 amp. for 5,000 volts, and for 7,500/12,500 GR Y volts. Is so constructed that reclosing mechanism is interchangeable with the door of the company's present 50-amp. indicating and drop-out cutout, making it possible to convert the latter into reclosing cutout. Should first fuse link blow, the door is pushed outward at the bottom. After a time-delay of one second the other fuse link is connected, thus restoring service if the fault is temporary. Should the second fuse blow, the complete door drops open and is isolated from the circuit. The time-



delay is controlled by a completely housed timing mechanism of the escapement type. It is said it will operate accurately over a long period of time under severe atmospheric conditions and over a wide range of temperatures. General Electric Co., Schenectady, N. Y.

"Curtain of Light"

The "Curtain of Light" equipment is a photoelectric apparatus designed to enable operators to work presses with complete safety, and at the same time provide complete automatic control. The light projector projects a curtain of light approximately 13 in. in height and 3 in. in thickness across the opening of the press. An obstruction to any portion of this light curtain causes a decrease in illumination reaching the sensitive area of the four photoelectric cells in the receiver. In the event of power failure, air failure, tube fatigue, lamp burnout, or any other failure, the unit will automatically stop the press in much the same manner as though the operator had intercepted a portion of the light beam. After the operator has inserted a piece of material and turns about away from the light beam, the control automatically causes the press to close. When it opens, after fabricating the material, a cam-operated limit switch removes the "Curtain of Light" safety control device from operation so that the operator may obstruct any portion of the light beam. At the top of the opening cycle the limit switch again allows the photoelectric equipment to maintain control and causes the safety feature to become operative. Electronic Control Corp., 2832 East Grand Blvd., Detroit.

TEN eloquent words from the letter of a customer whose large plant is isolated by miles and days from sources of replacement parts—and whose equipment is so generally operated by Cleveland Worm Gear Drives that the failure of even a single unit might have tied up the whole plant.

But *didn't!* His "Clevelands" had been installed 8 years previously and still showed no effects of wear when he wrote the above.

Examining at random the records of thousands of other Cleveland Worm Gear Speed Reducers installed 10, 15 or more years ago, reveals that this type of report is rather usual, not at all exceptional.

Wherever *your* plant may be, you can safeguard the earnings of your production equipment and go far toward stabilizing profits by installing "Clevelands"—the worm gear speed reducers that serve indefinitely with "not a moment of delay —not a penny of cost."

The Cleveland Worm & Gear Company, 3256 East 80th Street, Cleveland, Ohio.

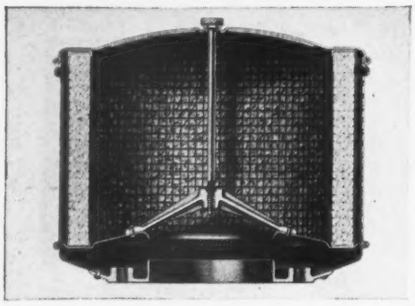
Affiliate: The Farval Corporation, Cleveland, Manufacturers of Centralized Systems of Lubrication

★

CLEVELAND *Worm Gear Drives*

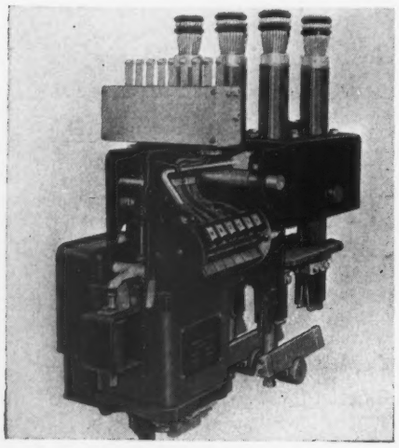
Air Filter

I-F Series Air Cleaner is used to remove dust and dirt from the intake of large gas or diesel engines, compressors, and pumps. Available in capacities up to 3,150 cu.ft. per min. at maximum velocities of 4,000 ft. per min. Can be used alone or with a silencer. Is of viscous-coated, impingement type and has filter consisting of a specially wound copper gimp coated with a viscous fluid. As an unusually large gimp winding is provided, the unit is capable of operating for many weeks without passing dirty air or becoming clogged. Constructed of heavy-gage metal. Burgess Battery Co., Acoustic Division, 111 West Monroe St., Chicago.



Circuit Breaker

"BR-30E" oil-blast circuit breaker is built for 400- and 600-amp. capacity at 7.5 kv. and 800 amp. at 5 kv. Rupturing capacity is 25,000 kva. It is complete with lifting ears, positive interlock bars, primary and secondary plug disconnectors. Solenoid mechanism and breaker head are an integral unit with internal operating linkage. While primarily for use in vertical-lift switchgear, it is also built for manual operation. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

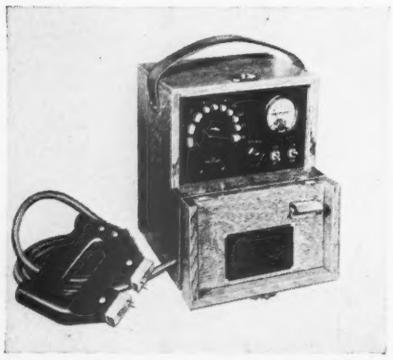


Pump

Pump for continuous operation to circulate water in refrigerating machines, air-conditioning units, heating systems. For use in connection with condensation return outfits for low-pressure boilers, it can be set on the receiver, as it is self-priming at a height of 3 ft. or less. Can be used for auxiliary and drainage pumping. Is equipped with ¼-hp. motor with bearings sealed to prevent water from entering. Motor shaft is extended to eliminate impeller shaft and coupling. No foreign matter can enter the oilless bronze pump bearing. Automatic operation, when desired, is made possible by a built-in mercury switch with overload protection to the starting and running windings. L. R. H. Labaw & Co., Inc., Belle Mead, N. J.

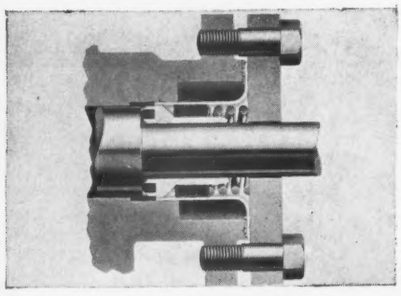
Moisture Meter

Style W Tag-Heppenstall moisture meter for lumber features low cost, light weight and small size. The panel is molded of plastic which is said to give higher insulation value and be more impervious to moisture than previous models. There is no relay so the number of batteries has been reduced from 8 to 3 from earlier models. Current drain is said to be one-tenth of that formerly required. The handle and cable are located in a separate compartment at the bottom of the case. Has switch that automatically turns off when instrument door is closed. C. J. Tagliabue Mfg. Co., Park & Nostrand Aves., Brooklyn, N. Y.



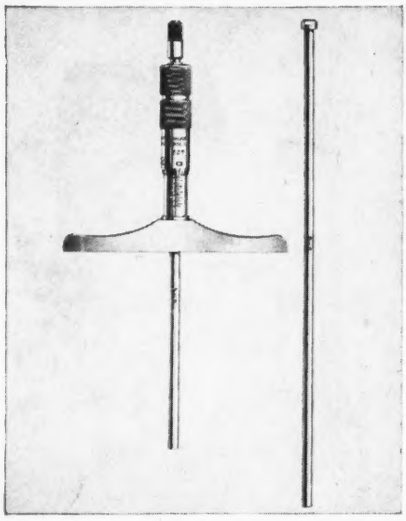
Shaft Seal

Shaft Seal is designed to eliminate leakage of gases and liquids around rotating and oscillating shafts of compressors and pumps. Has for its main sealing and wearing surface an anti-friction and self-lubricating compound insert in bearing metal. Sealing head is held firmly against shoulder on the rotating shaft to be sealed by strong spring pressure which also expands the packing rings. It is said to be effective and leak-proof on worn and scored shafts, as well as on new shafts. Has self-centering ring in sealing head. Syntron Co., 480 Lexington Ave., Homer City, Pa.



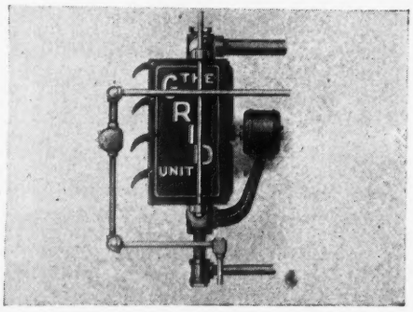
Depth Gage

Nos. 607 and 607RS micrometer depth gages have range of 3 to 9 in. Can be used to measure deep slots and holes by thousandths of an inch. The micrometer screw has a movement of 1 in. and the range of 3 to 9 in. is obtained by use of six measuring rods. Measuring rods are 3/16 in. in diameter, with hardened ends. Brown & Sharpe Mfg. Co., Providence, R. I.



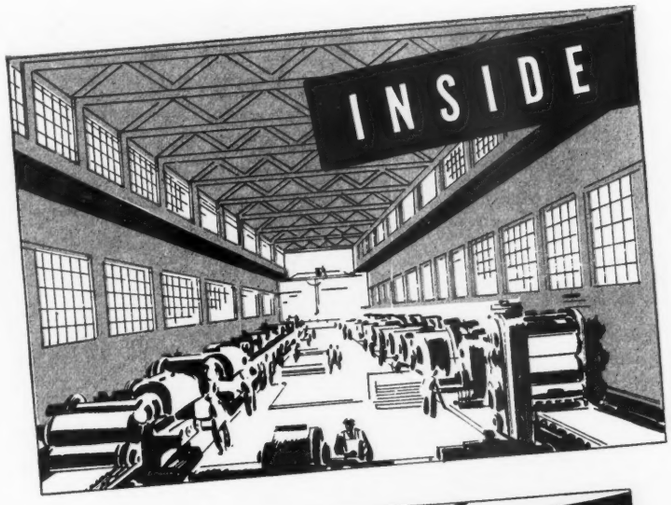
Humidifier

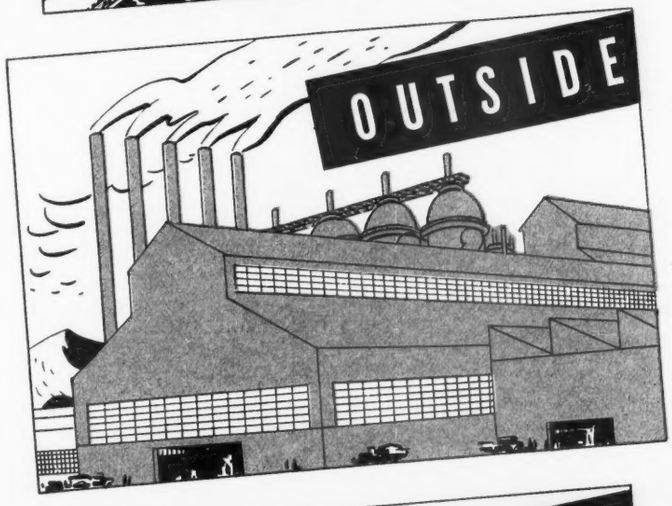
The "Grid" Humidifier is designed to be attached either in front or directly behind a unit heater. The humidifier may be operated with the unit heater or as an individual unit, and even though the fan on the unit heater is shut down, the humidifying action of the device continues to function until desired conditions are reached in the room. The operation of the humidifier is at temperatures higher than room atmosphere, which causes quick and instantaneous absorption of the humidifying fluid or gas. The Unit Heater & Cooler Co., Wausau, Wis.



Lighting Unit

"Canopy Localite" is designed to provide a relatively large spread of diffused illumination with a minimum of brightness and glare from the light source. Is made in three sizes of luminaires—20, 40 and 60 in. long—and the smallest size will be available on the regular Localite supporting arm. Is recommended for installations where the reflection from bright





ALCOA ALBRON
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ALUMINUM PAINT

EVERY BRUSHFUL

spreads economy, protection, long life

● There are many uses for Aluminum Paint about the plant; inside for reflectivity and resistance against smoke and fume; outside for corrosion resistance and for wood priming or top coats on company houses. Because it offers such outstanding service, it is rapidly becoming the universal paint for industry.

Large users who have facilities for making tests have discovered two important facts about Aluminum Paint: — Best results are obtained when genuine Alcoa Albron Paste or Powder with a quality vehicle suitable for each surface and purpose is used. Then efficient "leafing" of the millions of tiny Aluminum flakes is obtained. Then lasting reflectivity and an enduring coat of metal protection are assured.

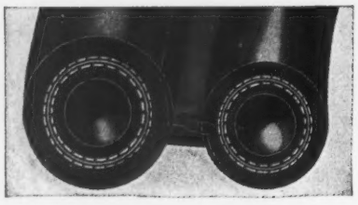
★ ★ ★ ALCOA ALUMINUM ALBRON ★ ★ ★

The best Aluminum Paint consists of genuine Alcoa Albron Paste or Powder and a vehicle suitable for the surface to be painted. Buy it from reputable paint manufacturers, their jobbers and dealers. For Aluminum Paint literature, write ALUMINUM COMPANY OF AMERICA, 2126 Gulf Building, Pittsburgh, Pennsylvania.

surfaces is a problem, such as metal scribing, typesetting, plate etching, bottle and glassware inspection, candy manufacture, etc. Some models are for overhead mounting only, some for portable stand mounting, and some for bench or table mounting. The Fostoria Pressed Steel Corp., Fostoria, Ohio.

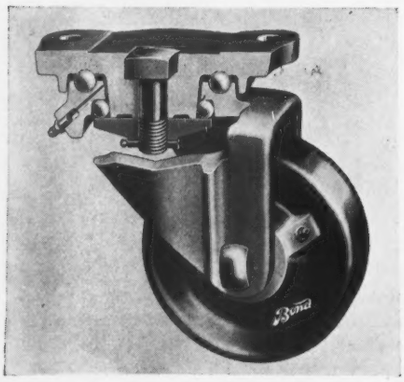
Hose

"Du-al" hose is a spray painting hose which combines the air and fluid hoses into one unit, the tubes being united by a web of solid rubber which is molded in one piece with the outer casing of the hose. The combination is said to be as flexible in use as a single line. Construction is reinforced and inner tube is compounded to resist chemical action of paints, lacquers, and so on. The outer sheath is designed to resist chemical as well as abrasive wear. For making connections, enough of the web is removed to spread the hose to the required outlets, further splitting being prevented by a tightly fitting collar. Available with $\frac{3}{8}$-in. fluid passage and $\frac{5}{16}$-in. air passage. Eclipse Air Brush Co., Inc., 79 Orange St., Newark, N. J.



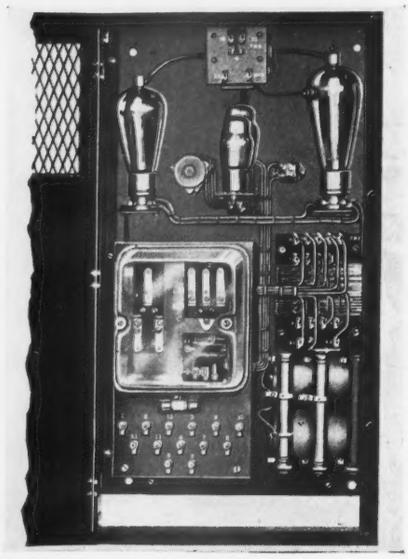
Caster

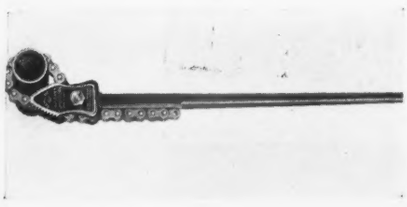
Type 36-A caster has two ball races of almost equal diameter set one below the other, permitting easy swiveling and compensating for wear. To relieve the king pin from side thrusts, it is surrounded by a projecting boss section of the base. To insure smooth operation and long life, both ball races are ground. There is a projecting flange around the outer ball race in the fork and a downward projecting flange on the base of the caster to form a labyrinth-type seal for retaining the lubricant and for protection against dust. A pressure lubrication fitting lubricates all moving parts of the ball race. Bond Foundry & Machine Co., Manheim, Pa.



Voltage Regulator

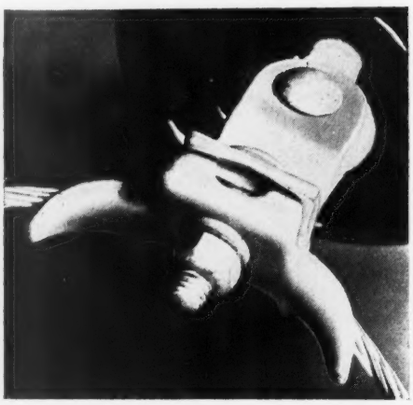
Two automatic electronic alternator voltage regulators have no moving parts. They are controlled rectifiers deriving their power from the a.c. generator and delivering the rectified d.c. to the shunt field of the exciter. Bulletin 5601 regulator starts within one-half cycle of the slightest change in generator voltage; Bulletin 5602 starts within one cycle. Bulletin 5601 regulator can be used with any method of excitation. It is designed with an isolated supply transformer, making the larger capacities more easily arranged for switchboard mounting. Bulletin 5602 regulator is designed for use with one exciter only. Variations of these regulators can be obtained to maintain constant voltage on 180-cycle generators. Ward Leonard Electric Co., Mt. Vernon, N. Y.





Chain Wrench

"Vulcan Supertong" is a chain pipe tong, drop forged from alloy and high-tensile steel, and heat treated. Design and structural features are identical with those of the company's "Vulcan" tongs but strength is considerably greater. Equipped with "Superchain" made from heat-treated alloy steel and cadium plated. Finished in gray enamel. Eight sizes for pipe $\frac{1}{8}$ to 18 in. J. H. Williams & Co., 75 Spring St., New York.

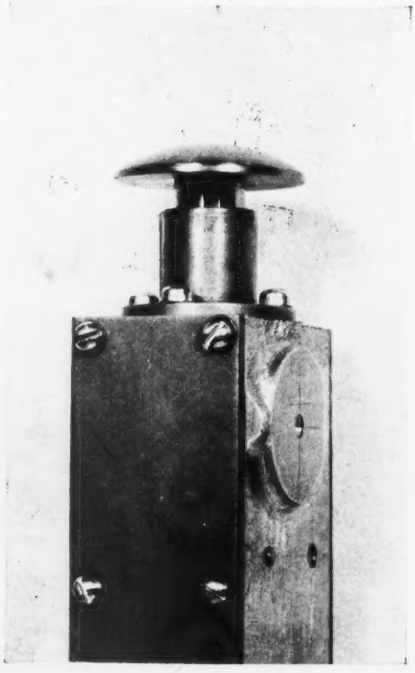


Clamp

Angle clamp is easy to install and permits angles from 30 to 120 deg. to be turned without the necessity of dead-ending the conductors and using jumpers. Is a one-piece assembly and no parts need to be removed for attaching the conductor. With the conductor laid in the seat of the clamp, it is gripped by merely tightening the nut on the bolt which holds the keeper piece on the conductor and main body casting. The keeper piece is reversible, having two sizes of conductor grooves, and will accommodate all commercial sizes of conductors from No. 6 AWG to 2/0 AC SR with armor rod. While light in weight, the clamp has ample strength for conductor tensions in excess of 5,000 lb. Ohio Brass Co., Mansfield, Ohio.

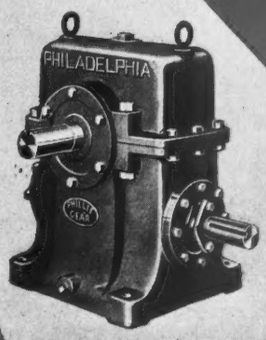
Switch

"Namco" super-sensitive line voltage switch may be used as limit switch, safety switch, or in connection with counting devices, circuit breakers, liquid level controls, gage devices, relays, pressure controls. Made in five different types: rotary, light contact, oscillating, plunger, and push. Designed for a.c. application. Ratings of 2 to 10 amp., 125-600 volts. Internal operating levers in all models are equipped with an adjustable steel spring, insuring correct pressure on the contact

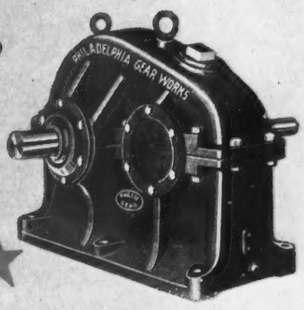


Star Performers

★ VERTICAL MOTOREDUCER

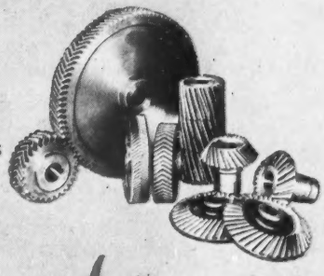


★ WORM GEAR SPEED REDUCER



★ HERRINGBONE GEAR SPEED REDUCER

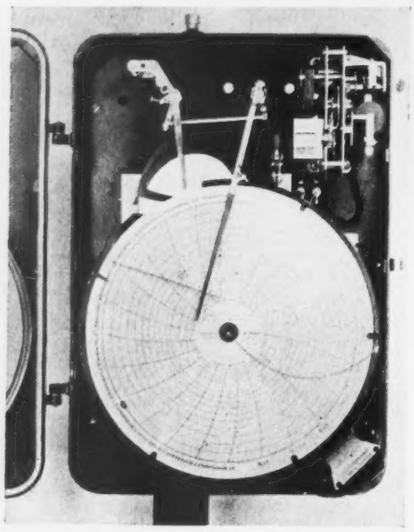
★ GEARS
ALL TYPES—ALL SIZES



PHILADELPHIA Products

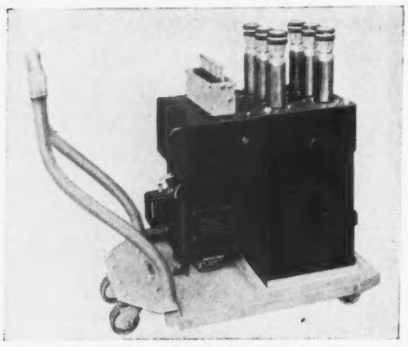
PHILADELPHIA GEAR WORKS
Industrial Gears and Speed Reducers
ERIE AVENUE AND G STREET, PHILADELPHIA

button. Provisions have been made to wire for normally open or normally closed contacts. Mounting is made with two ¼-20 screws, entering the two tapped holes provided in the bottom of the housing. The National Acme Co., 146 East 131st St., Cleveland.



Flow Meter Integrator

Electric integrator totalizes flow once every 15 sec. The company's mechanical and electrical flowmeters for measuring flow of gases or non-viscous liquids are now equipped with this type of indicator. A flat disk cam is designed to coincide with the flow law, so that it mechanically computes the square root of the differential pressure across an orifice plate or Venturi tube construction in a pipe line. The values obtained are totalized by means of a counter and are indicated on a six-figure integrator dial. The Bristol Co., Waterbury, Conn.

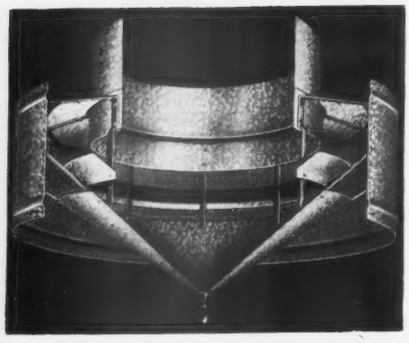


Circuit Breaker Unit

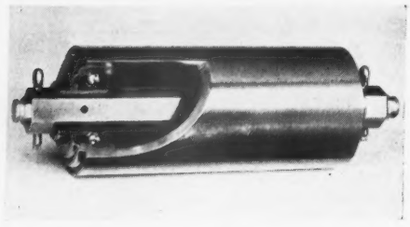
This oil circuit breaker unit is designed for use in metal-clad switchgear. Solenoid operating mechanism, control switches, interlocks, and manual operating handle are combined in a self-contained unit. By means of a truck, the entire unit can be placed in or removed from the switchgear inclosures. Rated at 7.5 kv., 25,000 kva. Delta-Star Electric Co., 2400 Block, Fulton St., Chicago.

Ventilator

"Standard Gravity Ventilator" features an inverted lower louver which directs any upward flowing air currents through the ventilator head, thereby increasing its siphonage action and preventing backdrafts. Protected free outlet area is well in excess

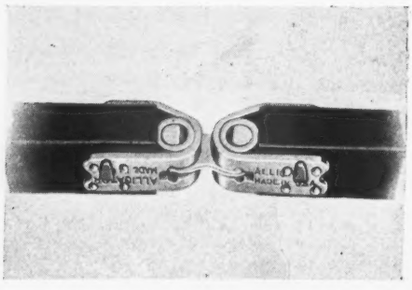


of airshaft area, assuring an unrestricted passage through ventilator head. Generous overhang of ventilator top assures stormproofness. Made of galvanized steel with galvanized iron internal braces. Can be furnished in optional materials such as copper-bearing steels, aluminum, copper, asbestos-protected steel. Screening is provided in two ways: by a framed circular screen fastened into the ventilator airshaft and removable from below, by a permanent screen positioned vertically in the protected outlet area of the unit. Burt Mfg. Co., Akron, Ohio.



Conveyor Roller

Heavy-duty conveyor roller has 3½-in. outside diameter stainless steel tubing, 5/16-in. wall. The bearing has steel inner and outer labyrinth seals, hardened inner and outer ball races, and thirteen 9/16-in. diameter hardened steel balls, assembled within a pressed steel jacket. The assembled roller has an average rated capacity of 2,200 lb. Has hexagon axle which is drilled at the ends, where grease fittings are applied. Can be furnished in lengths ranging from 6 in. up to 48 in., and can be spaced in the frames on centers ranging from 4 in. up. Mathews Conveyer Co., Ellwood City, Pa.



Belt Fastener

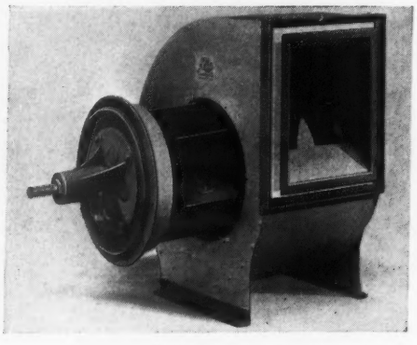
"Alligator V-Belt Fastener" is designed for joining "C" section V-belts of fabric core, cross weave construction. Has double rocker pin supported in bronze bushings and features a method of holding the end plate to the belt end without materially weakening the belt or bulging its sides. The rocker pin is made of special alloy steel hardened to give long lasting service. No metal touches the pulleys. Application is said to be rapid and easy and done with tools supplied by the manufacturer. Flexible Steel Lacing Co., Chicago.

Fire Extinguisher

"Super" fire extinguisher of the 1 qt. C.T.C. type has a moisture-proof breather designed to prevent corrosion. It is shockproof, and is said not to freeze at 40 deg. below zero. It has an extra heavy brass nozzle recessed to protect it against breakage. There is a forged brass pump handle, leak-proof shut-off valve, heavy seamless drawn brass shell, double-acting pump, double-end pick-up. Buffalo Fire Appliance Corp., 44 Central Ave., Buffalo, N. Y.

Blower

New improved line of high-temperature exhausters is manufactured in a wide range of types and sizes for various temperatures. Class "L" is for operating temperatures up to 800 deg. F., class "M" for temperatures up to 1,000 deg. F., class "H" for temperatures up to 1,250 deg. F. Special units can be furnished for temperatures up to 1,800 deg. F. Available in double-housing insulated and air-cooled construction, and in single housing uninsulated construction. Parts subjected to high temperatures are fabricated of various heat resisting alloys. Double-row, self-aligning ball bearings are used and kept cool by air-cooling method which prevents transmission of heat to the shaft and the bearings. Industrial Gas Engineering Co., 201 East Ohio St., Chicago.



TOO MUCH TIME.. TOO MUCH MONEY.. FOR *PAMPERED* MINE CARS!

Shell showed this Coal Company how to Cut Mounting Costs of Mine-Car Maintenance!

"THEY'RE worse than a bunch of spoiled brats," said the Collinsville Coal Corp.'s maintenance engineer. "We have to nurse 'em like babies!"

A large number of plain-bearing mine cars are in use at the ¾-mile workings at Collinsville, Ill. Under the difficult conditions involved, this mine had always found the lubrication of their mine cars a slow, expensive and often unsatisfactory procedure. Shell was called in to help them solve this problem once and for all!

Mine-car lubrication is an old story to Shell. They had met—and licked—problems like this before. They made their recommendation to the Collinsville engineers: an entirely different type of lubricant . . . a Shell grease especially designed to meet the rigorous conditions of mine-car operation—and an inexpensive grease kit for its application!

The Shell recommendations were applied! And "pampering" the mine cars came to an end at Collinsville! A check after several months' trial showed lubrication time had been *cut in half* . . . cost sheets disclosed *a 25% saving* in lubricant alone!

The list of tough lubrication problems solved by Shell is growing every day. For this case is but one of thousands. The reason: Shell's "Invisible Element," the ingenuity to discover the cause of the trouble—the resources to remedy it *correctly!* This *plus* in lubrication is always available to you. Simply get in touch with your nearest Shell office.

SHELL

SHELL INDUSTRIAL LUBRICANTS

Operating Shorts

Hot Bearings Indicated by Lamp and Siren

GILBERT LINDGREN, *Electrical Foreman*
Hudson Valley Fuel Corporation
Troy, N. Y.

A hot bearing alarm has operated very satisfactorily on our gas boosters for several years.

One of the features is a panel board with sixteen ruby indicating lamps which burn continuously and indicate normal temperatures. Under each lamp is a nameplate which identifies the bearing. When a bearing heats up a mercury switch opens the circuit to the indicating lamp for that bearing and a siren sounds. All the other lamps remain lighted.

By having all lamps burn under normal conditions the possibility of an alarm coming in on a defective lamp is prevented. When a lamp burns out it is noticed and replaced at once.

On the contactor panel two contactor coils are connected to a common shaft. The holding coil maintains the upper row of contacts in the closed position. When one of the contacts is opened by a hot bearing the holding coil drops out, opening the top row of contacts. At the same time the reclosing coil is energized, closing the bottom row of contacts. The siren continues to operate until the mercury switch is reset and the contactor panel returned to the normal position by opening the control trip switch and closing the pushbutton marked Control Switch (Close).

Mr. Lindgren's contribution has been awarded the $15 payment offered by the editors for the best Operating Short submitted during the past month.

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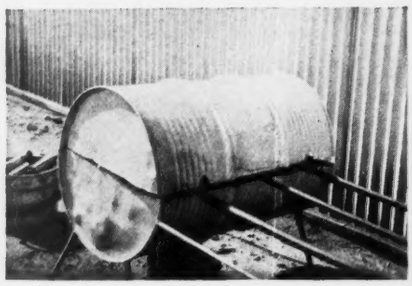
Staggered starting of motors may be advisable when plant is operating near peak capacity.

Drain Rack for Dripping Mops

H. M. TENNY, *Denver, Colo.*

Employees of the Skelly Oil Company's Cunningham, Kansas, refinery solved a perplexing problem which bothers most industrial plants—how to keep mops in good shape, ready for use, and prevent them from dripping on floors, thereby causing a hazard.



A discarded gasoline drum was cut in half, and hinges welded to one side. Legs, and a rack to hold the mop handles, were also welded to the drum. These were made from ½-in. gas pipe. A pan was placed under the bunghole to catch drippings. Mops placed in the drum, as shown, drain and dry.

•

Proper Selection of Building Materials Saves Trouble

FREDERIC OAKHILL, *Plant Engineer*
Bauer & Black Division of
The Kendall Company, Chicago

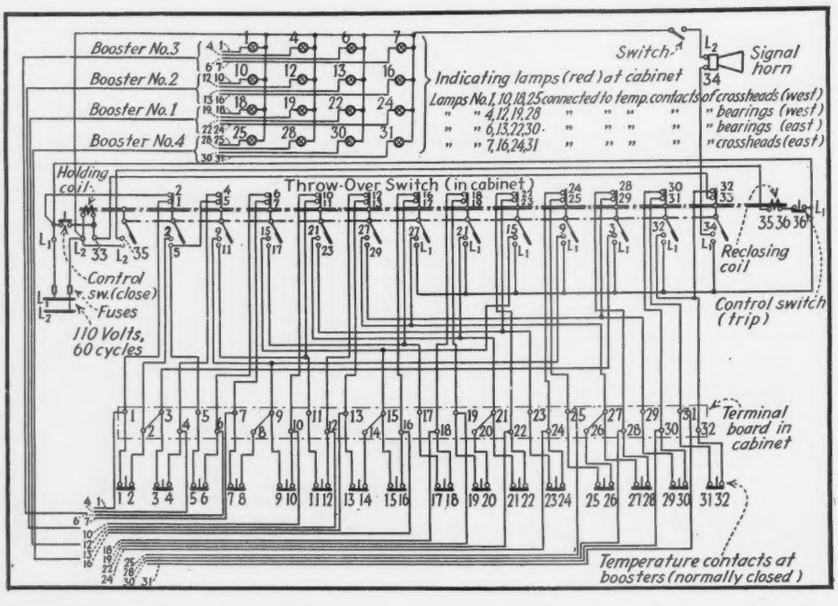
Interesting problems were presented when it became necessary to make radical changes in an existing building in order to set up a department for the manufacture of a peculiarly delicate product. Important requirements were that the air in the department must be kept as free from dust as possible, and that the temperature and relative humidity be closely controlled. Naturally, it was desired to keep both initial and maintenance costs as low as consistent with the requirements.

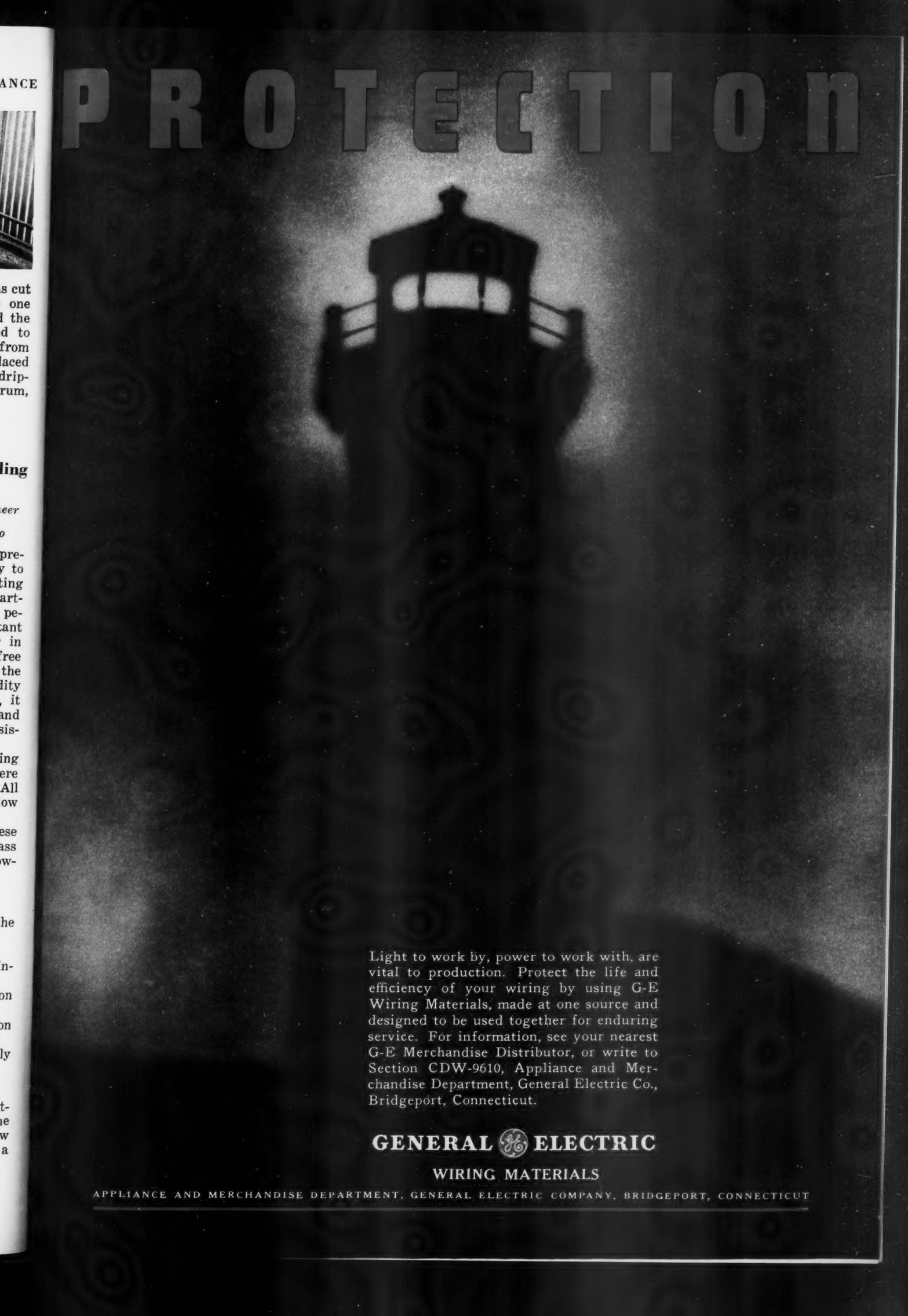
The outer walls of the building are of brick, 12-in. thick, and were plastered on the inside face. All windows were fitted with hollow metal frames and sash.

It was decided to replace these frames and sash with hollow glass blocks in order to secure the following advantages:

1. Greater light infiltration.
2. Soft, diffused light.
3. Pleasant appearance within the working area.
4. Reduction of solar loads.
5. Elimination of dust and air infiltration.
6. Decrease in the refrigeration and heating requirements.
7. Elimination of condensation on windows.
8. Elimination of corrosion likely to occur on metal sash.
9. Low maintenance costs.

Partitions separating this department from the remainder of the building were constructed of hollow tile, finished on both sides with a


Booster No.3
Booster No.2
Booster No.1
Booster No.4
Switch
Signal horn
Indicating lamps (red) at cabinet
Lamps No.1, 10, 18, 25 connected to temp. contacts of crossheads (west)
" " 4, 12, 19, 28 " " " " " bearings (west)
" " 6, 13, 22, 30 " " " " " bearings (east)
" " 7, 16, 24, 31 " " " " " crossheads (east)
Holding coil
Throw-Over Switch (in cabinet)
Reclosing coil
Control sw. (close)
Fuses
110 Volts, 60 cycles
Control switch (trip)
Terminal board in cabinet
Temperature contacts at boosters (normally closed)


PROTECTION
Light to work by, power to work with, are vital to production. Protect the life and efficiency of your wiring by using G-E Wiring Materials, made at one source and designed to be used together for enduring service. For information, see your nearest G-E Merchandise Distributor, or write to Section CDW-9610, Appliance and Merchandise Department, General Electric Co., Bridgeport, Connecticut.
GENERAL ELECTRIC
WIRING MATERIALS
APPLIANCE AND MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

moisture-proof plaster. The other interior wall surfaces were finished with the same material in order to prevent the disintegration that is almost invariably experienced with ordinary plaster in the presence of high humidity.

An industrial air-conditioning system equipped with efficient filters controls the atmospheric conditions, and keeps the air remarkably free from dust.

The manufacturing equipment is built largely of stainless steel, or rustless alloys.

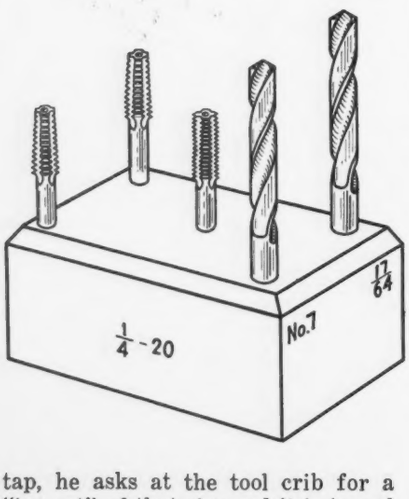
•

Tap Sets Are Time Savers

GORDON W. RICHARDS, *Orange, N. J.*

One plant has found it can save time for its maintenance gang on small drilling and tapping jobs by the use of "tap sets." These consist of wooden blocks each holding a tap drill, clearance drill, bottom tap, and two lead taps.

When a man has a hole to drill and



tap, he asks at the tool crib for a "tap set" of that size and it is issued to him on one check instead of five as would be the case were he to order each item separately. The time of the tool crib attendant is also saved.

Stand Adding Machines on Inclined Supports

EMIL J. NOVAK, *Omaha, Neb.*

Where a portable adding machine is used on a flat-top desk or workbench, it is much easier to operate when rested on an inclined support. The keys are brought into a position where they can be seen without straining the eyes, and where they can be reached without getting the hand and arm into an unnatural position. This eases the strain on the operator. Such a support can be made of wood and set at an angle suitable for the operator.

•

Production Control Form for Printing Establishment

G. YATES, *Buffalo, N. Y.*

This production control form we have found handy for the printing establishment of small to medium size. It is a manila envelope printed on front and flap as shown.

Rear View

37500 — Set o — Cuts — Elec. Proof — Bind Rule — Standing Press Outside — 1

PROOF OUT
37500 2
TO RULER
37500 3
RULED
37500 4
OK. FOR PRESS
37500 5
Locked for Press
37500 6
PRINTED
37500 7
BINDERY
37500 8
Outside Work
37500 9

SPECIAL INSTRUCTIONS

Front View

NO. 37500 Date Proof
Customer Job
Address Order Taken by His Order No.

QUANTITY	DESCRIPTION	
		1
		2
		3
		4
		5
		6

SET — SIZE folded x SIZE finished x
Electros | From
Proofs — Proofs | Prints on Sides
Make Electros on hand

REMARKS:

STOCK NO.	SHEET	FROM SIZE	WGHT.	SENT TO KIND AND COLOR	Date sent CUT TO
1		x			x
2		x			x
3		x			x
4		x			x
5		x			x
6		x			x

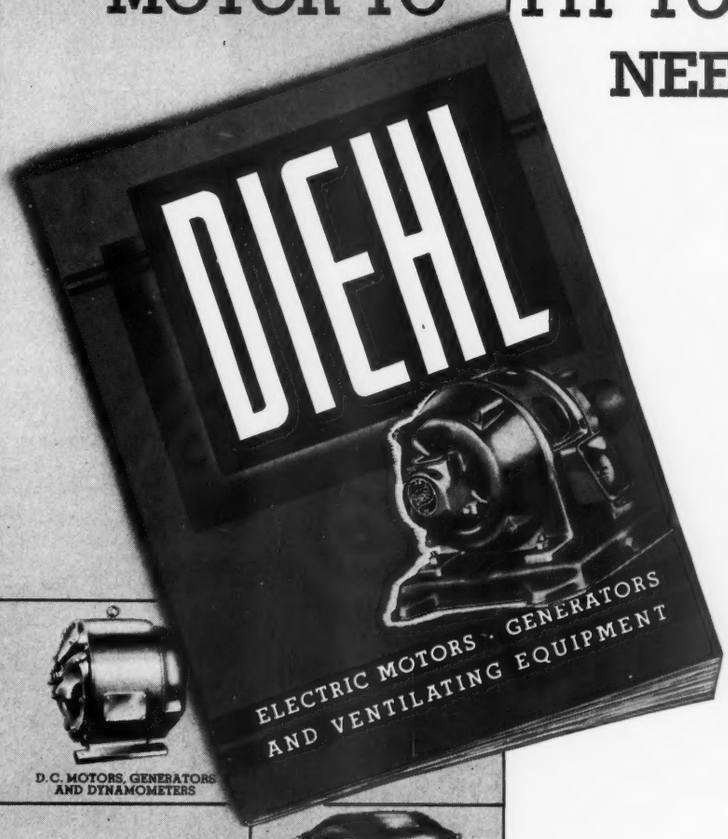
INK, Inside Cover
Score Ink used
Perforate Number in from to
Pressman COUNTER RECORD 1 2 3
Feeder 4 5 6
To be Bound
Fold Folds
Gather Stitch Pad in Pad at
Number From to in Ink
Punch Sheets C. to C. Holes
Perforate Sheets
Round corner Gum
DELIVER TO
In Balls. of Price
Comp. Type on Slides
PUT TWO COMPLETE COPIES IN JACKET WHEN COMPLETE

Special Notice

$15 will be paid for the best Operating Short submitted during the month of October. The Editors are the judges. Other Shorts accepted will be paid for at attractive rates

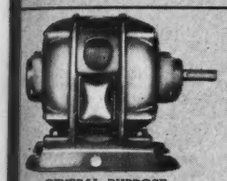
Upon receipt of an order, one of these envelopes is sent to the shop superintendent who studies the specifications, issues necessary orders, and encircles on the first stub (large stub in upper left hand corner of illustration) operations required. Stub number one is then hung on a

SELECT THE EXACT MOTOR TO FIT YOUR NEEDS

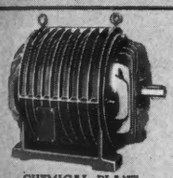


TYPICAL DIEHL APPLICATIONS

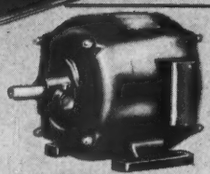
...ING MACHINES
...CONDITIONING MACHINERY
...TATORS
...ERS' MACHINERY
...ANCING MACHINES
...TERY CHARGING SETS
...WERS
...TLING MACHINERY
...CULATING MACHINES
...ERAS & PROJECTING EQUIP'T
...DY MAKING MACHINES
...NING MACHINERY
...ENT MAKING MACHINERY
...MICAL PLANT MACHINERY
...URNS
...ARETTE MAKING MACHINES
...CULATORS, AIR
...Y MAKING MACHINES
...AL MACHINERY
...KE MACHINERY
...FEE MACHINERY
...MPRESSORS
...NVEYORS
...NES
...RY APPARATUS
...TAL MACHINES
...HWASHERS
...ERS
...CTRO-PLATING EQUIPMENT
...VATORS
...ALATORS
...S, EXHAUST
...E ALARM SYSTEMS
...UR MILL MACHINERY
...D PROCESSING MACHINERY
...ERATING EQUIPMENT
...ASS MAKING MACHINERY
...NDING MACHINERY
...STS
...DRAULIC MACHINERY
...NDRY MACHINERY
...OMS, TEXTILE
...CHINE TOOLS
...RILL PRESSES
...UNCH PRESSES

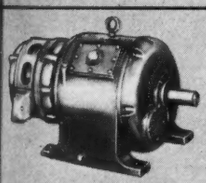

GENERAL PURPOSE SQUIRREL CAGE MOTORS

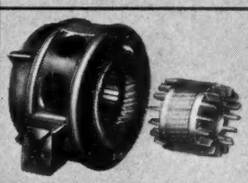
D.C. MOTORS, GENERATORS AND DYNAMOMETERS

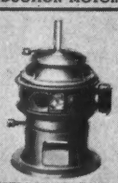

CHEMICAL PLANT MOTORS

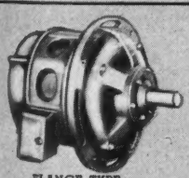
A.C./D.C. UNIVERSAL MOTORS


REPULSION START INDUCTION MOTORS

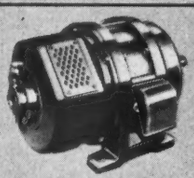

GEAR MOTORS

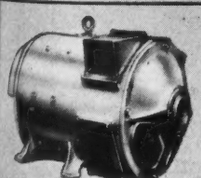

SHAFTLESS MOTORS

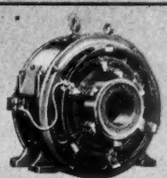

VERTICAL MOTORS—RING BASE

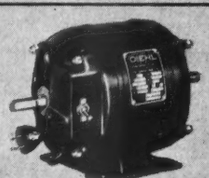

FLANGE TYPE MOTORS

VERTICAL MOTORS TRIPOD BASE


SLIP RING MOTORS


DIRECT CURRENT MARINE MOTORS AND GENERATORS

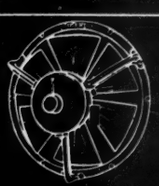

D. C. ENGINE TYPE GENERATORS

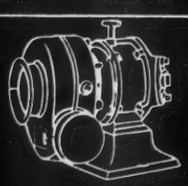

SPLIT PHASE FRACTIONAL HORSEPOWER MOTORS

DIEHL MANUFACTURING CO., Elizabethport, N. J.
Pioneer Manufacturers of Motors, Generators and Fans
Electrical Division of THE SINGER MANUFACTURING CO.
ATLANTA BOSTON CHICAGO DALLAS NEW YORK PHILADELPHIA

DIEHL DESK AND BRACKET FANS

DIEHL AIR CIRCULATORS


DIEHL EXHAUST AND VENTILATING FANS


DIEHL PORTABLE VENTILATING SETS

Plant and product modernization demand the utmost in motor drive efficiency, economy and dependability. There is only one RIGHT motor to meet the requirements of each application.

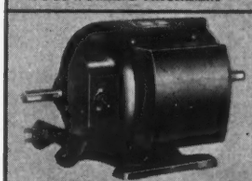
The diversified Diehl line offers many types and sizes from which to select the exact motor to fit your needs. Standard motors are obtainable from stock for usual requirements. Special designs for exceptional conditions can be developed in a minimum of time. All are products of the same facilities and abilities which have enabled Diehl to design and produce motors that have satisfactorily met the requirements of exacting manufacturers in all branches of industry for half a century.

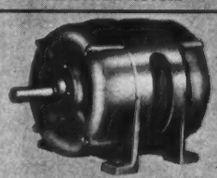
Tell us your requirements and our engineering staff will gladly recommend the proper motor equipment to meet your needs.

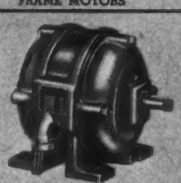
To all who use or choose motors the Diehl Catalog No. 1881 illustrated above will prove very helpful. Write for a copy.

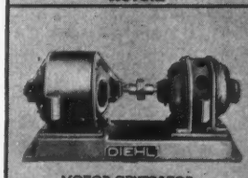
TYPICAL DIEHL APPLICATIONS

MACHINE TOOLS CONT'D
SHAPERS
GRINDERS
BORING MILLS
PLANERS
LATHES
SHEARS
BLANKING PRESSES
ETC.
METAL WORKING MACHINERY
MINING MACHINERY
MIXERS
MOTOR-GENERATOR SETS
OFFICE APPLIANCES
OIL BURNERS
OVENS
PAINT MAKING MACHINERY
PAPER MAKING MACHINERY
PETROLEUM PRODUCTS MACH'Y
POLISHING MACHINERY
POWER PLANT MACHINERY
POWER TABLES
PRINTING MACHINERY
PULVERIZERS
PUMPS
RECORDING INSTRUMENTS
REFRIGERATING MACHINERY
SCALES
SEPARATORS
SEWING MACHINES
SHOE MAKING MACHINERY
SMELT'G & REFIN'G MACH'Y
SOAP MAKING MACHINERY
STOKERS, MECHANICAL
STONE WORKING MACHINERY
SUGAR REFINING MACHINERY
TABULATING MACHINES
TESTING MACHINES
TEXTILE MACHINERY
TYPEWRITERS
UNIT HEATERS
VACUUM CLEANERS
VENTILATING EQUIPMENT
WASHING MACHINERY
WINCHES
WOODWORKING MACHINERY

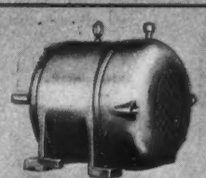

CAPACITOR MOTORS


TEXTILE SPINNING FRAME MOTORS

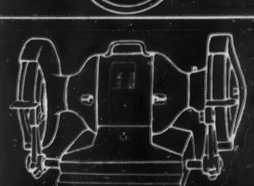

TEXTILE LOOM MOTORS



MOTOR-GENERATOR SETS


TOTALLY ENCLOSED FAN-COOLED MOTORS

Diehl


DIEHL ELECTRIC GRINDERS

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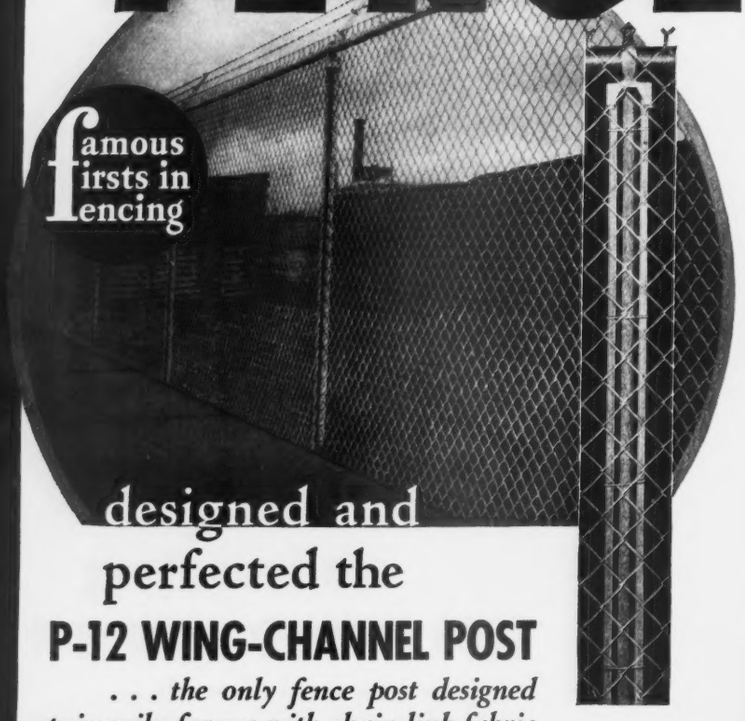

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AMERICA'S FIRST WIRE FENCE—SINCE 1883

control board. As job progresses the remaining stubs are detached and hung over the first stub on the board. They remain there until the order is complete. A glance at the control board at any time indicates progress of an order.

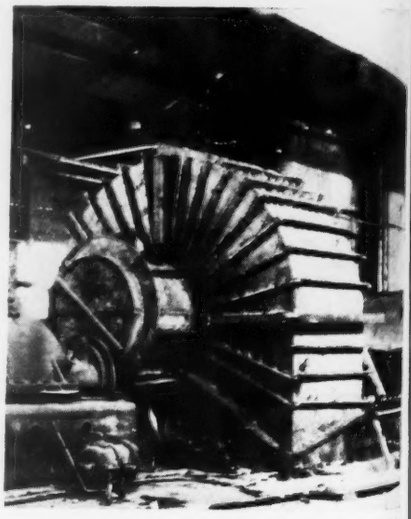
When an order has been finished the envelope is filed numerically. An index book arranged alphabetically by customers' names makes it possible to find quickly any order recorded. Besides the name and order number this book shows date of order, customer's address, and description of the job.

Completely equipped trucks for maintenance men save the boys many a long walk, all needless and expensive.

Welded Housing Facilitates Drying Out Large Motor

SOURCE, *American Murex Corporation New York*

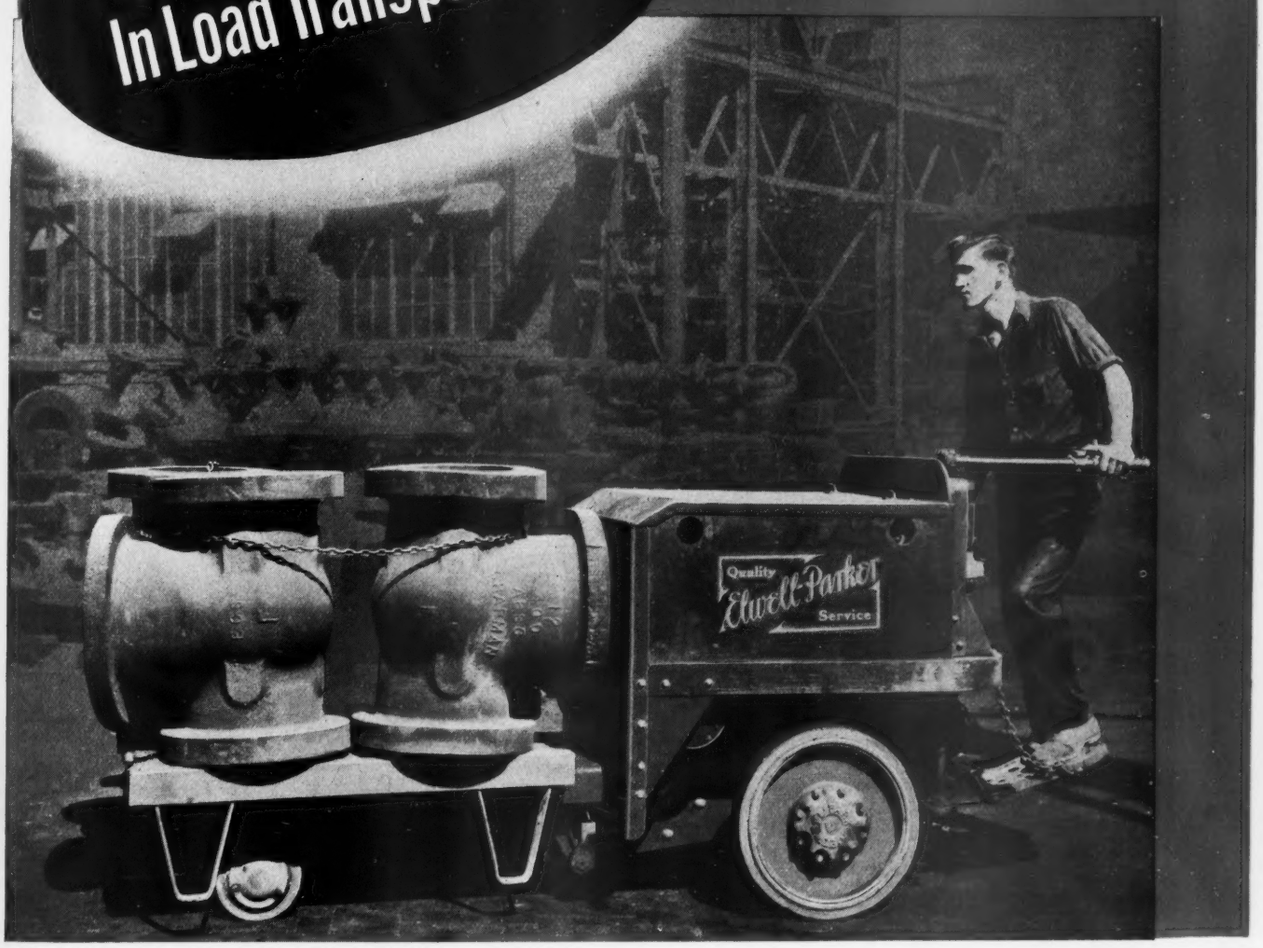
When the plant of the Andrews Steel Company, Newport, Ky., was flooded last winter, some valuable machinery was completely submerged. Among the items was a



3,000-hp. motor that remained under water for more than a week.

The method used to dry out this motor was somewhat unusual, and highly effective. Application of much heat was out of the question, because of the almost certain injury to the insulation. It was decided, therefore, to construct an air-tight housing around the motor and employ both heat and vacuum. In this way, because of the much lower

Effect New Savings In Load Transportation WITH SELF-LOADING ELWELL-PARKERS



● Ask your manufacturer friend whether he knows about Elwell-Parker Self-Loading Platform Trucks. His answer will come promptly:—"Why *of course!*"

But not everyone *does,* though everyone *should.* For in practically all of the metals industries, this speedy, capable, low-cost Elwell-Parker Truck Unit has a greater variety of important uses than any other type. The picture shows why.

Here a soundly-applied Elwell-Parker is hustling valve bodies for an important manufacturer—picking up, conveying big loads speedily, setting them down—then whirling back for the next load! That's Elwell-Parker's quick formula for bringing materials-handling costs down and *keeping* them down.

What Elwell-Parkers are doing in the valve business, thousands more are duplicating in other heavy industries. *This is the point:—*

Whatever you make, you have loads to move—you must bring down your transportation costs permanently. Send for an Elwell-Parker Engineer. He will make a preliminary plant survey—will show you just how an Elwell-Parker System can pay for itself in a few months. The Elwell-Parker Electric Company, 4323 St. Clair Avenue, Cleveland, Ohio.

New Type **ELWELL·PARKER** *Trucks*

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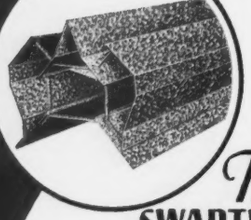
ARCHITECTURALLY and MECHANICALLY CORRECT

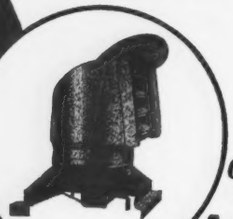
The NEW SWARTWOUT ROTARY

Low slung vane—less overall height—new curved body—oversize outlet—greater capacity—welded steel tubing interior bracing—stainless steel ball bearings enclosed in dust-tight housing—and many other superior features.



The SWARTWOUT-DEXTER HEAT VALVE

The *original* continuous ventilator and *only* "Heat Valve" made. Provides large area continuous roof opening at small comparative cost. Large capacity—fits in architecturally with lines of building.



The NEW SWARTWOUT AIRJECTOR

The greatest advancement in power roof ventilation in a decade—Discharge opening is always *away from the wind*—No wind or baffle plate resistance for the fan to overcome—thus greater capacity per H.P. is secured, with longer life and maximum economy.

Swartwout Ventilation Engineers are available for consultation without obligation. Located in all principal cities. Write direct for the complete Swartwout catalog.

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boiling point of water under a vacuum, it was possible literally to boil out all moisture from the motor at a temperature low enough to be perfectly safe.

The welded steel casing, shown in the illustration, was 12 ft. long and 5 ft. wide, with a drum on each side to inclose the shaft. Made of ¼-in. low-carbon steel plate reinforced with steel bars and I-beams, it was completely arc-welded in place, using carbon-molybdenum steel electrodes that had been salmerged for at least fourteen days, but they were not injured.

A test of the housing after completion showed only one small leak, which was quickly plugged.

When all was ready the temperature inside the housing was brought up to 150 deg. F., and air was pumped out to establish a vacuum of 28 inches. This temperature and vacuum were maintained for three weeks, after which the housing was removed. The motor was found to be thoroughly dried out.

Careful examination of the housing after this test showed that every inch of welding was in perfect condition.

One of the foreman's big jobs which he often forgets is to promote good feeling throughout his department.

Sure-Fire Quality Control of Raw Materials

SOURCE, *McAleer Manufacturing Company, Detroit*

Laboratory control of raw materials is sufficiently general in industry to call for no comment. But a technique employed at this company might profitably be adopted in a good many other concerns to make sure that the laboratory really controls.

This company produces polishes, rubbing compounds, and buffing compositions, principally for automotive use, and it employs a wide variety of raw materials. Some of the solvents come in tank cars and are pumped directly into large outdoor tanks in the factory yard. On such materials, the rule is that nothing may be transferred from car to tank until it has been passed by the laboratory. Therefore, any material in the tanks is unquestionably approved for quality.

On the multiplicity of materials which come in smaller lots, however,

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—open by foot pressure and close automatically. Made for heavy duty plant use in 6, 8, 10 and 14-gallon sizes. Justrite Oily Waste Cans are approved by the Underwriters' Laboratories to help you end the hazard of oily waste—and to give you lower insurance rates.

Write TODAY for your copy of "Cut Corners on Insurance Rates," a little folder of big facts. Justrite Safety Products are carried by all leading hardware and mill supply distributors.

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2 DEB-E-LITE:—For walls and ceilings that you can keep clean and white, for better working conditions that increase plant efficiency.

3 DECOSEAL ALUMINUM:—For walls, partitions and ceilings, for pipe lines and pipe coverings. Wherever you want a metallic aluminum finish.

WHATEVER your business may be . . . Gas, Electric, Food or Textile, light or heavy manufacturing . . . you know the importance of paint in Plant Maintenance.

But there's a vast difference in paints; their original cost, covering and hiding power, workability, and in their efficiency for each special application.

Exposed metal needs a tough paint to stand the gaff of the elements and corrosive industrial fumes. Many walls and ceilings need a white paint that stays white, that resists dirt accumulation and frequent cleaning. In other cases, you may prefer ceilings, walls, beams and pipes finished in lustrous, long-lasting aluminum.

In the Debevoise Laboratory, technical training and *practical* experience have been combined to formulate paints that help you do a better, longer-lasting paint job at a lower over-all cost.

Before you plan your next paint job, consult the Debevoise Company's Free Manual . . . see how the DEBEVOISE line of paints meets every requirement in your factory.

Then specify DEBEVOISE Paints. Wherever you use them they will save the surface and your dollar.

FREE Write for your FREE copy of the Debevoise "Plant Maintenance Manual". This concise manual is a working handbook, not a sales portfolio. It covers every important phase of paint selection and application in plant, machinery and equipment maintenance.

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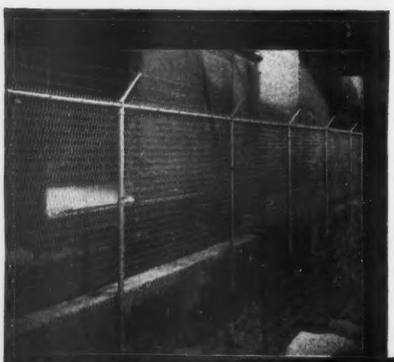

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Steelcrete also offers you the benefit of Expanded metal for industrial fence and property enclosure. It has new features of economy, excellent appearance, and protective strength —all explained in the Special catalog which will be sent on request.

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a method is followed which absolutely insures against any slip-up of quality. This is based on a factory rule that the one unforgivable sin is to use material from a container that does not show the laboratory's approval.

The laboratory has a large rubber stamp which reads, in letters perhaps 4 in. high, *"O.K. LABORATORY."* When a shipment comes in from a supplier, the laboratory sends out for samples from each drum, keg, box, or bale, and until its report is made the material rests in something resembling a condition of quarantine. To be sure, it may be stored right alongside an older shipment which is passed for use, but until it bears the prominent letters it cannot be used.

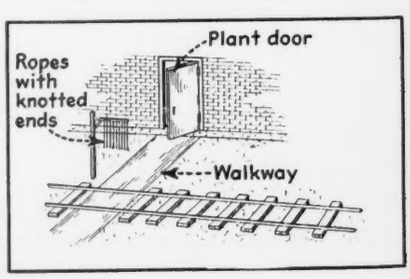
There is nothing startling in this idea—it is too simple to be startling. But the point is that it is 100 per cent effective. Even a non-English-speaking employee can be held accountable for knowing whether a material is o.k.'d—so no mistakes occur.

One company has rescheduled its equipment so that heavy machinery is kept out of operation in daylight hours. This has smoothed out power consumption and reduced demand charges.

Knotted Rope Guard Prevents Crossing Accidents

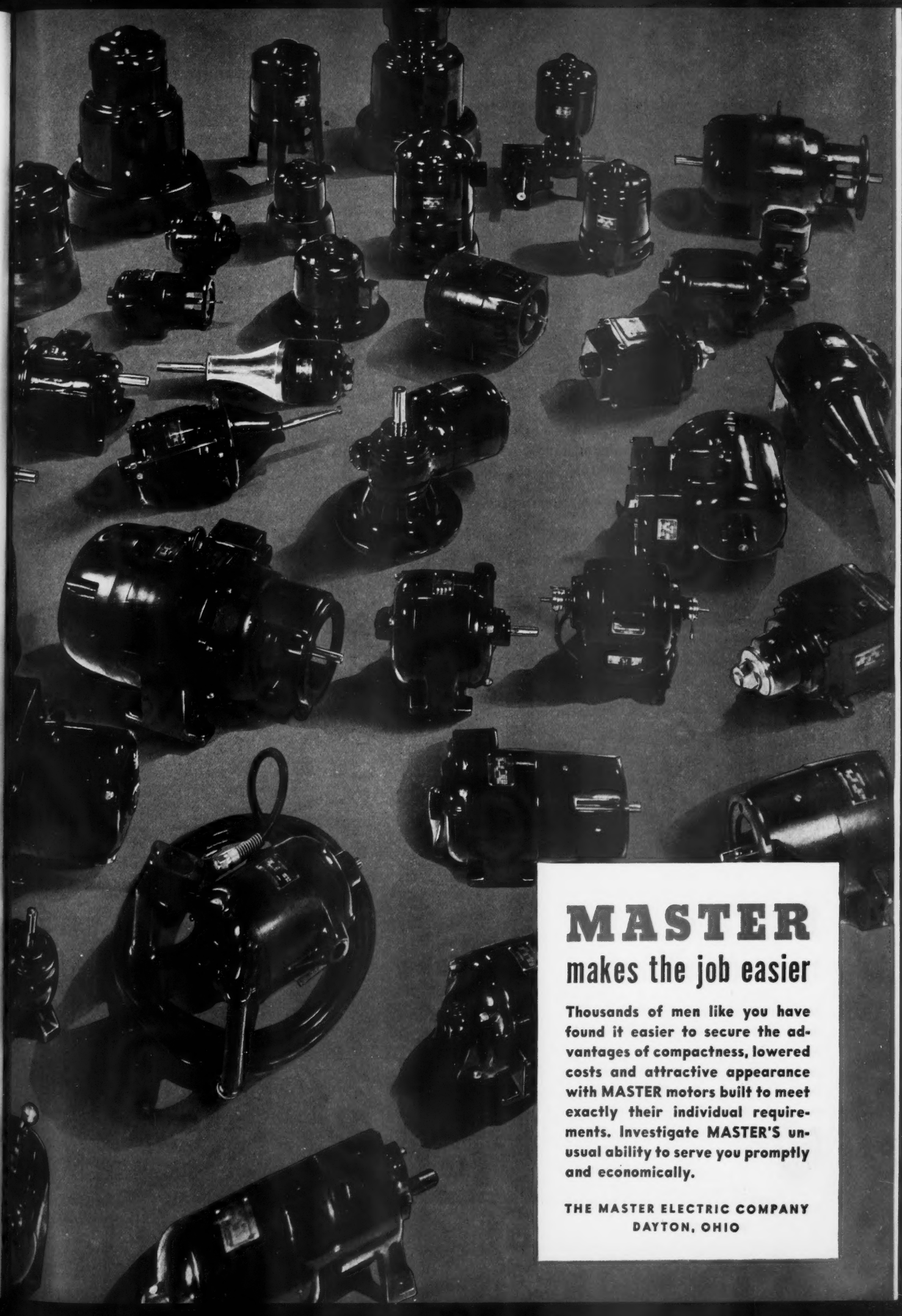
S. H. COLEMAN, *Roanoke, Va.*

Where access to and from plant doorways must be made across railway tracks located near the wall of the building a potential accident hazard exists. This danger is particularly acute when persons are



leaving the building, especially if they are hurrying and an outward swinging door obstructs the view for a greater part of the distance between doorway and tracks.

One large plant having a number of such doorways, after ex-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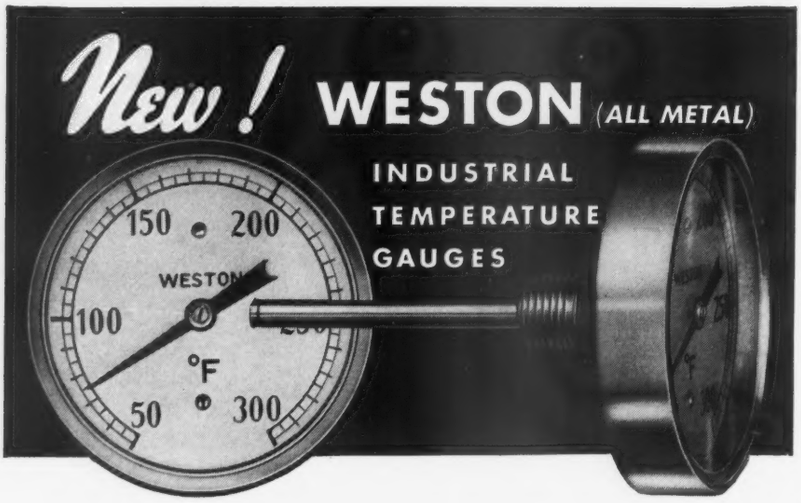

1. New, scientific principle of temperature indication . . . all metal operating element . . . no glass, no fluids.
2. Accuracy of 1% over entire scale.
3. *No damage from over-temperatures or severe vibration.*
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5. Corrosion-resistant materials used throughout.
6. Easy to read . . . easy to install . . . standard stem lengths to 24″ . . . ranges up to 1000°F.

Sectional view showing operating parts of WESTON *Industrial Temperature Gauge*

Operating on a new but thoroughly proved principle which provides sustained accuracy and easy readability, and which eliminates breakage from over-temperatures, the new WESTON industrial temperature gauges are finding wide application throughout all industry for the usual as well as many unusual temperature indicating requirements. Complete information is available. Communicate with the nearest WESTON representative, or, send coupon for literature.

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periencing a number of near accidents caused by persons walking directly into the path of moving cars and engines, installed a warning device as shown in the sketch to avoid a possible major injury or fatality. Consisting of a screen of knotted ropes suspended with their bottom ends about 5 ft. above the walkway, this guard strikes unobservant pedestrians in the face, causing them to slacken speed and raise their heads so that anything on the tracks comes into view. Suggested by similar devices used by the railroads to warn trainmen of low bridges and tunnel entrances, this guard has so far proven a successful method of preventing crossing accidents.

A metal-working plant requiring wearing of goggles on only obviously hazardous jobs spent $1,668 per year on eye accidents. When it made goggles compulsory on *all* jobs the cost was cut to $88.

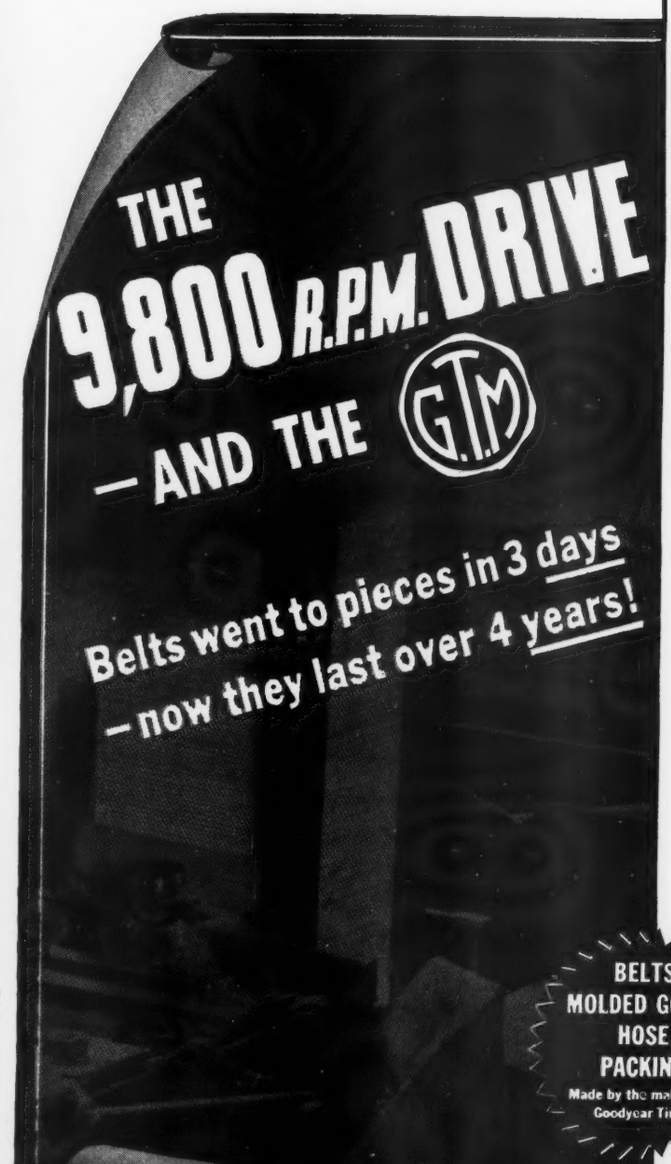
Voltage Unbalance Raises Cost of Motor Operation

R. J. W. KOOPMAN, *Instructor, and* H. R. REED, *Associate Professor, Electrical Engineering Department, Michigan College of Mining and Technology, in* ELECTRICAL WORLD

Lowered motor efficiency means increased cost of operation. Voltage unbalance at motor terminals is a significant contributor toward poor motor efficiency. Reduction in efficiency of 2 or 3 per cent, even up to 15 per cent in extreme cases, is important when power bills are large. Unbalanced motor voltage may make that much difference.

Any unbalanced condition of three-phase voltage applied to an induction motor may be considered as two balanced systems of three-phase voltages, one producing rotation in the desired direction and the other, usually much smaller, tending to produce rotation in the opposite direction. The component of voltage producing the desired rotation is termed the positive-sequence voltage; the component opposing this rotation is termed the negative-sequence voltage.

Terminal-voltage unbalance reduces the torque of a motor because of the reduction of positive-sequence voltage, and the presence of negative-sequence voltage. The input to the motor is increased since it is the sum of the inputs due to the positive- and negative-sequence



IF YOU have a belt-eating high speed drive in your plant we think you will find the following experience of unusual interest.

Several years ago the H. G. Wilcox Company of Tacoma, Washington, developed a machine to manufacture battery separators at low cost. Its success depended upon operation of a grooving device, driven by a 2¾" pulley, at a speed of 9,800 revolutions per minute.

Many different types of belts of highest quality were tried out on this machine but the cyclonic speed and terrific flexing caused by the small pulley diameters and short center literally tore them to pieces—*some lasting only 10 minutes; the best only 3 days!*

Not a shutdown in 57 months

Then the G.T.M.—Goodyear Technical Man—was called in and on his analysis and recommendation a Goodyear COMPASS "10" Endless Belt was applied in January 1933. Today, almost five years later, the Goodyear COMPASS is still driving this machine—*and there has never been a single shutdown for belt adjustment or repair.*

A second COMPASS-driven machine is now operating at 12,000 r. p. m., and Mr. H. G. Wilcox, president of the company writes, "If it were not for Goodyear COMPASS Belts these machines could not have been made a success."

Why not let the G.T.M. demonstrate how COMPASS' patented endless cord construction will tame your most vicious drives? To bring this friendly consultant to your office, just write Goodyear, Akron, Ohio, or Los Angeles, California—or the nearest Goodyear Mechanical Rubber Goods Distributor.

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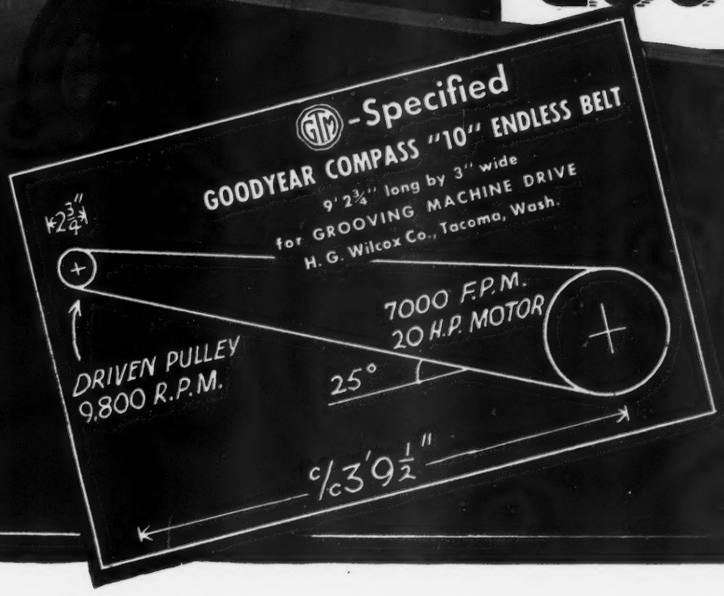

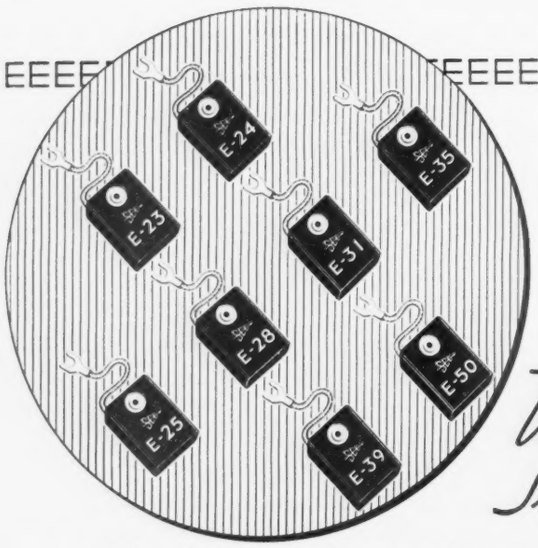

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is the end of the search for motor and generator brushes that will produce the best results on eighty out of every hundred machines now in service or going into service. These eight grades of Speer Series E electro graphitic brushes are the perfected result of more than a generation of research and development in Speer laboratories and plants, in the field and in the plants of customers.

Choose the right "E" grade for your machines and see the improvement over brushes you now think satisfactory. Speer Brush Data Sheets will indicate the right type. Write for a set, stating how many machines you wish to investigate.

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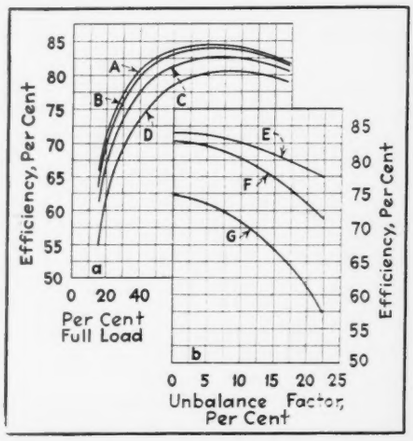
voltages as though each voltage were acting on a separate motor. Although the reduction in torque is small, the effect of this, combined with the increase in input, greatly reduces the efficiency.

The table shows the relationship among terminal voltages, positive- and negative-sequence phase voltages, and unbalance factor in per cent for balanced terminal voltages and when none of the terminal voltages are equal. Unbalance factor is defined as the ratio of negative-sequence voltage to positive-sequence voltage.

The effect of voltage unbalance for a specific case is shown in the accompanying curves of a calculation and test on a 5-hp., three-phase, 220-volt, 60-cycle induction motor operating under the first four ter-



Curves in diagram *a* show the efficiency of a 5-hp., three-phase, 220-volt induction motor operated under different percentages of full load at *A*, balanced voltage; *B*, 5.26 per cent unbalance factor; *C*, 10.57 per cent unbalance factor; *D*, 15.97 per cent unbalance factor. In diagram *b* the curves show the efficiency of the same motor operating under different unbalance factors at *E*, full load; *F*, one-half load; *G*, one-quarter load

minal voltage conditions given in the table. The reduction in efficiency with voltage unbalance is clearly evident. Curves *C* and *D* represent rather severe conditions of unbalance, and are shown more for emphasis than for their practical value. However, curve *B* represents a condition which frequently occurs and shows the practical importance of keeping the line voltages balanced.

The second graph shows the relationship between per cent efficiency and unbalance factor when the motor operates under full, one-half, and one-quarter loads. The rate of decrease in efficiency with increase in

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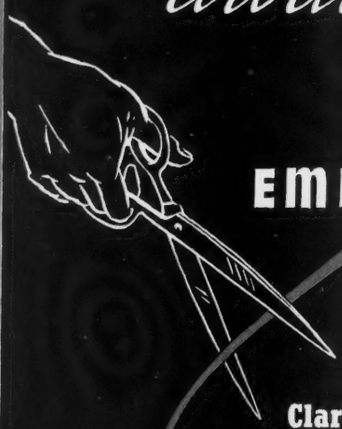
ESPECIALLY IN EMERGENCY SITUATIONS



Clark representatives in more than 20 centers await your command. Phone the nearest office listed below.

The Clark A. C. Automatic Across-the-line Starter for squirrel cage motors eliminates the separate safety switch between the starter and the power line

Clark's response will be in sympathy with the conditions that prompt your call. Manufacturers, railroads, utilities, municipalities and other users of electrical equipment who are occupied with projects of modernization, rehabilitation or new construction will find the Clark force anxious to assist. Red tape will not be allowed to interfere.

• • •

BALTIMORE • BIRMINGHAM • BOSTON • BUFFALO • CHATTANOOGA • CHICAGO • CINCINNATI • CLEVELAND • DALLAS DENVER • DETROIT • LOS ANGELES • MINNEAPOLIS • NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH ST. LOUIS • SAN FRANCISCO • SEATTLE • TORONTO

THE CLARK CONTROLLER COMPANY

1146 EAST 152nd STREET CLEVELAND, OHIO

READ THIS! *Walker-Turner Co., Inc. offers this tool as proof that PRECISION small tools can be built to sell economically. Because we make small tools ONLY—because we've made intensive studies of small tool design and production—you can safely buy this tool for steady production work where precision is a factor of importance.*

In Precision . . .

THIS D925 DRILL PRESS RANKS SIDE-BY-SIDE WITH YOUR BIG MACHINES!

$53.90 (with ⅓ H.P. AC 60 cycle, 110 volt motor)

Compare it point-for-point: six-spline spindle, mounted on 4 precision ball bearings, with pilot wheel feed, calibrated depth stop, positive return spring action. Jacobs (0 to ½") Key Chuck. 2¾" column, 30" high. High quality materials throughout, machined to close tolerances. Descriptive bulletin on request.

WALKER-TURNER CO., INC.
33107 Berckman St. Plainfield, N. J.

WALKER-TURNER *Engineered* **POWER TOOLS**

unbalance is even greater at fractional loads than at full load.

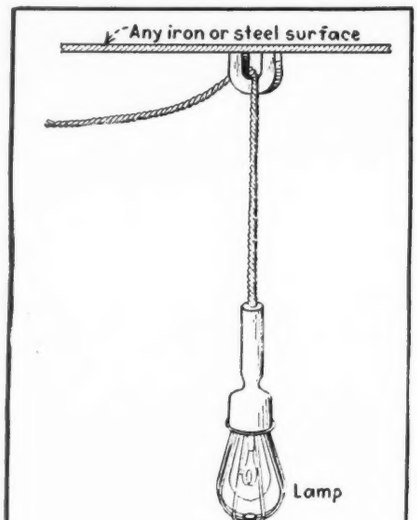
Case	Terminal Voltage	Phase Voltage Positive-Sequence	Phase Voltage Negative-Sequence	Unbalance Factor Per Cent
A	220 220 220	127.0	0.00	0.00
B	210 220 230	126.6	13.38	10.57
C	200 220 240	126.2	20.15	15.97
D	190 220 250	126.9	6.67	5.26
E	180 220 260	125.6	27.00	21.50

To make certain that operators are thoroughly instructed in the use of their tools is to take one of the most elementary safety precautions.

Using Small Magnet to Support Extension Lamp

H. G. PACK, *Los Angeles*

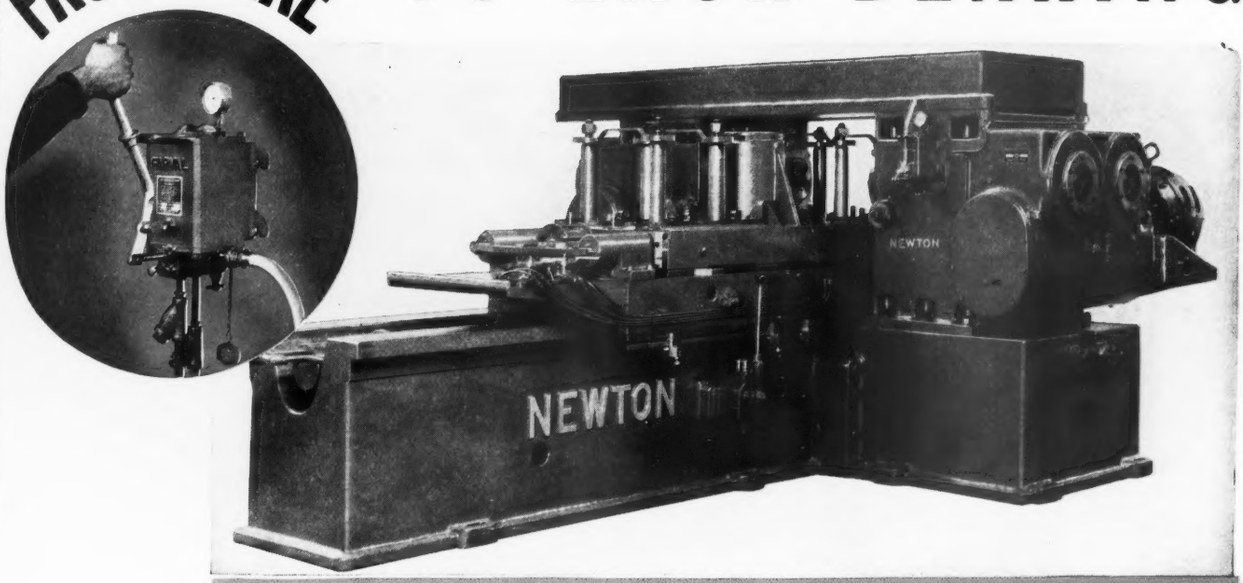
The problem of mounting an extension lamp in the place where you need it is never solved once and for all, because every repair job presents the same problem over again, under different circumstances. Consequently, I have found that much time and inconvenience can be saved by making use of the astonishing holding power of the new Alnico magnets. With such a magnet it is simply a matter of looping the extension cord through the yoke, or hanging the hook from it.



Rare indeed is the job where there is not plenty of iron around, and one has but to try one of these small magnets to convince himself that they will "stay put."

The magnet I use weighs 4

FROM HERE TO EACH BEARING



With Accurate Control Throughout

Your oilers *may* know the location of every bearing on your equipment, but will they remember the remote ones when hurrying to get the job done?

You *ought* to know—because guesswork in lubrication cannot be tolerated. A single burned-out bearing may paralyze production of a machine, a department, or even an entire plant.

But—with Farval on your equipment, it is not necessary that *either* of you shall know. Because a Farval Centralized System supplies positive lubrication to all bearings, with accurate control throughout:

—by delivering clean lubricant from a central station under high pressure

—to a group of bearings in exact, measured quantities

—operation is constant and positive, regardless of the number of bearings in the system, and

—not a bearing is missed

—Farval provides adequate lubrication and protection at every point

—quickly pays for itself through reduced labor of oiling

—reduced power consumption and increased bearing life

—increases production by reducing outage time

—and prolongs life of equipment

A nearby Lubrication Engineer will gladly call with complete information and technical data. The Farval Corporation, 3256 E. 80th St., Cleveland, O.

Affiliate of The Cleveland Worm & Gear Co., Cleveland, Manufacturers of Automotive and Industrial Worm Gearing

FARVAL

CENTRALIZED SYSTEMS OF LUBRICATION

Special Delivery to Every Bearing

The World's Fastest Fully Automatic TIME CLOCK

32% Faster!

The Stromberg Uni-Speed

Liberal Trade-In Allowance On Your Old Time Clocks

It's both good business and good policy to trade in your present time recorders—whether Stromberg-made or otherwise—for this new, faster, modern time clock. The cost of time now being lost would probably more than pay for the new equipment.

• Because it is *one-hand operated* this new, fully-automatic electric Time Clock is 32% faster! With its speedy one-hand operation, employees move along quickly and easily without having to stop because of aisle congestion. Thousands of minutes are saved for you and for them in a year!

Employees see at a glance its visible recording on the front of their time cards. And they appreciate the fact that their time is kept and printed *accurately*.

This rugged new automatic Time Clock meets the special requirements of any business, no matter how complicated the hours or work shifts. It spotlights time irregularities in red ink (if desired) and cuts in half much of the timekeeper's routine work. Write for information.

TIME JOB RECORDERS

A Key to Accurate Costs . . . A Check on Wasted Time

Only an accurate, automatic record will give you the facts for knowing your real cost facts. Stromberg Job Recorders spotlight wasted time, reveal the relative efficiency of your men. Trouble free, foolproof, they require no winding or regulation and use hardly any current. Make them the backbone of your cost system.

Let Other Stromberg Equipment Regulate Your Entire Business Day

Stromberg Time Equipment includes In-and-Out Recorders, Job Time Recorders, Automatic Time Stamps, Wall Clocks, Program Instruments, and Process Timing and Signalling Instruments. All Stromberg Instruments are electrically operated and can be furnished in single units; or combined and synchronized in one system controlled by a Master Clock, or Western Union Control Clock; or equipped with synchronous motors.

STROMBERG ELECTRIC COMPANY
231 West Erie Street, Chicago, Illinois
Stromberg Time Recorder Co. of Canada, Ltd.
284 King St., W., Toronto
SALES AND SERVICE OFFICES IN ALL PRINCIPAL CITIES

STROMBERG TIME

MAIL THIS COUPON TODAY!

STROMBERG ELECTRIC COMPANY
231 West Erie Street, Chicago, Ill.

Please send me illustrated booklet containing complete information on the new Stromberg Uni-Speed Time Recorder. No obligation incurred.

*Firm Name*_____
*By*_____
*Street*_____
*City*_____ *State*_____

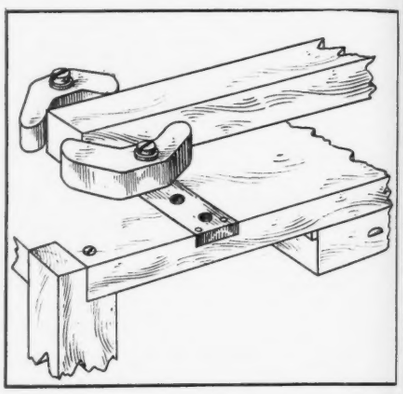
ounces. Aside from the above use it is a handy tool for picking up small iron or steel parts.

These magnets may be obtained at the larger hardware stores, or from concerns handling scientific equipment.

Self-Clamping, Adjustable Bench Stop

C. H. WILLEY, *Penacook, N. H.*

The sketch shows construction details for a very handy self-clamping bench stop which can be used not only for holding wood pieces being planned, but is equally effective for steel stock being chipped.



The two pivoted jaws are the same shape and made from cold rolled steel bars set into the bench is a length of cold rolled steel bar with several holes drilled and tapped in it. The jaw pins fit into any of these holes so that work of different dimensions can be handled.

Questions and Answers

How Distinguish Between Phase Wires?

We experience difficulty in getting the proper direction of rotation of the three-phase motors driving portable hoists, conveyors, and certain other equipment that is plugged into any one of a number of stations. That is, at one or more stations the rotation may be correct, but at others it is reversed and motor leads must be interchanged. I presume the cause of the trouble is that the same line wires (1, 2, or 3) are not connected to corresponding terminals of all receptacles. But, how can I distinguish the 1, 2, or 3 lines from each other, at the receptacles? I wish that other readers who have had this problem would tell me how they solved it.—L.S.

(*Continued on page 148*)

Stanley Car Banding Sealer.

Stanley Car Banding Tightener.

Stanley Car Banding Snips.

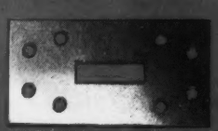
Carloading Modernized!

Stanley Car Band.

Stanley Double Crimp Car Banding Seal.

Stanley Car Banding Stays.

Stanley Staples.



Stanley Anchor Plates.

Stanley Banding Reel Truck. Holds four ¾" coils or two 1¼" coils.

By a *quicker* and *cheaper* method of load bracing, freight car shipments are now *better* protected than ever before! Stanley engineering research has developed the Stanley Car Banding System which modernizes carloading. It is complete—Stanley supplies everything you need from staples to tools. It will quickly pay for itself in savings on labor, damages and dunnage.

STANLEY *Car Banding System* SAVES MONEY THREE WAYS!

1. *Car Banding,* **as compared with wooden bracing, has reduced claims substantially. The Freight and Claims Division of The Association of American Railroads will verify this statement!**

2. *Reduces Bracing Costs.* **Saves many dollars in material costs and hours in labor, per car.**

3. *Saves on Freight.* **Dunnage is reduced up to 1400 pounds per car. Think of the saving in freight costs!**

THE STANLEY WORKS

New Britain, Conn.

STANLEY SW

HERE'S WHAT WE DID FOR WESTINGHOUSE

Here is the system of loading and Car Banding electric motors which Westinghouse is using. A Stanley engineer will be glad to help you work out a plan to meet your needs and save you money *three ways.* Write for new free catalog on the Stanley Car Banding System. Ask for SS1.

An electric hoist quickly lowers the heavy motor onto the waiting skid. . . .

Wrapped in Kraft paper, motor is firmly secured to skid by two Stanley Eversafe Nailless Straps. . . .

A roller conveyor carries the motors, strapped to the skids, to the shipping room.

Hand trucks easily cart the motors, securely strapped to skids, into the freight car.

In each end of car, motors are "Car Banded" into three "floating units."

Loads in both ends of the car are "Stanley Car Banded" for a safe trip.

STANLEY CAR BANDING SYSTEM

GUARANTEED FOR LIFE

The Automatic Washer Company of Newton, Iowa, one of the leading and oldest manufacturers of home laundry equipment, has used LUBRIPLATE lubricants exclusively and continuously since 1932. Dozens of carloads of LUBRIPLATE have been sealed in Automatic washer transmissions and GUARANTEED FOR LIFE of the machine. Automatic washers never have gear trouble.

"It's the Film"

Equipment manufacturers everywhere are swinging to LUBRIPLATE lubricants for quiet, long-lasting operation and reduction in replacement expense.

Lubriplate Division

FISKE BROTHERS REFINING CO.

Established 1870

129 Lockwood St. Newark, N. J.

Plants: Newark, N. J. & Toledo, Ohio

(Continued from page 146)

RECENTLY the same kind of problem arose, when it became necessary to make sure that several polyphase motors would rotate in the same direction when connected to any one of several receptacles.

When the wiring was laid out each wire was made a different color, red, blue, and black being specified in this case. The electrician was given a diagram showing the location of the terminals in the receptacles, and was instructed to connect the coded wires to them in the proper sequence. Hence, all receptacles were connected in the same phase relation and since the plugs can be inserted in one position only, it is evident that when once connected for proper rotation each motor must always rotate in the same direction.

Any method of marking wires could be used effectively to give the same results. Existing wiring can be phased out by removing two fuses, checking all receptacles for the remaining hot wire, and then reconnecting them in the proper relationship.

Likewise, the terminals of the motor can be marked in any manner that will insure proper reconnecting. Spare motors should be tested beforehand and have the leads marked for immediate use, so as to avoid the possibility of having to reconnect them for proper rotation, after installation.

EDWARD F. WEHLAGE, *Dubuque, Ia.*

All outlet receptacles and cable terminal plugs, or other kinds of connections, must be of non-reversible type, or the connections plainly marked so that the proper motor leads will always be connected to the proper line wires.

Then test and mark outlets of proper polarity, connect all motor leads to plugs, and open the circuit and interchange any two line wires to outlet terminals that give the wrong direction of rotation.

If preferred, the circuit may be opened and each line wire traced to the corresponding outlet terminal by means of a low-voltage lamp circuit or other test outfit.

R. F. SHERFY, *Sunbury, Ohio.*

THE SAME problem developed in connection with a power line that supplied several towns and manufacturing plants. The men responsible for repairs and maintenance were not engineers, and phase rotation was a great mystery to them.

We adopted a very simple, and perfectly obvious, method of testing the line after repairs or changes. Before picking up any of the load the boys were instructed to plug in a small three-phase motor and note the direction of rotation. If it ran counterclockwise and the voltage was the same on all phases, the line was considered ready for the load.

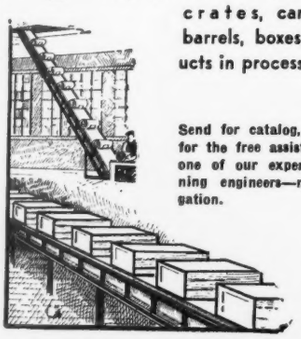
I suggest, therefore, using one motor for testing, connecting all of the

New Ways to CUT MATERIALS HANDLING COSTS

INCREASED COSTS MUST BE OFFSET THROUGH BETTER MATERIALS HANDLING METHODS

We have established "SAVINGS POINTS" in every industry . . . unloading and loading, inter-departmental, floor to floor and to and from bins, tanks and hoppers.

A complete line of portable and permanent conveyors for handling fuel, loose materials, packages, crates, cartons, bales, barrels, boxes, and products in process.



Send for catalog, or ask for the free assistance of one of our expert planning engineers—no obligation.

PORTABLE MACHINERY COMPANY

Division of A. B. Farquhar Co., Limited

CLIFTON, N. J. Lakeview Ave. **BOX C-10** CHICAGO, ILL.

YORK, PA. 2549 N. Keeler Ave.

HE'S NOT AFRAID!

The worker on a Dayton Safety Ladder has no fear of falling. He uses both hands, works faster and better, saves time and money.

There is no tipping, no wabbling. The Dayton has wide platform with protecting guard rail. Made of airplane spruce — light and strong—sizes 3 to 16 feet. Moderately priced.

Write Dept. FMM-10 for details.

THE DAYTON SAFETY LADDER CO.

121-123 WEST 3rd ST., CINCINNATI, O.

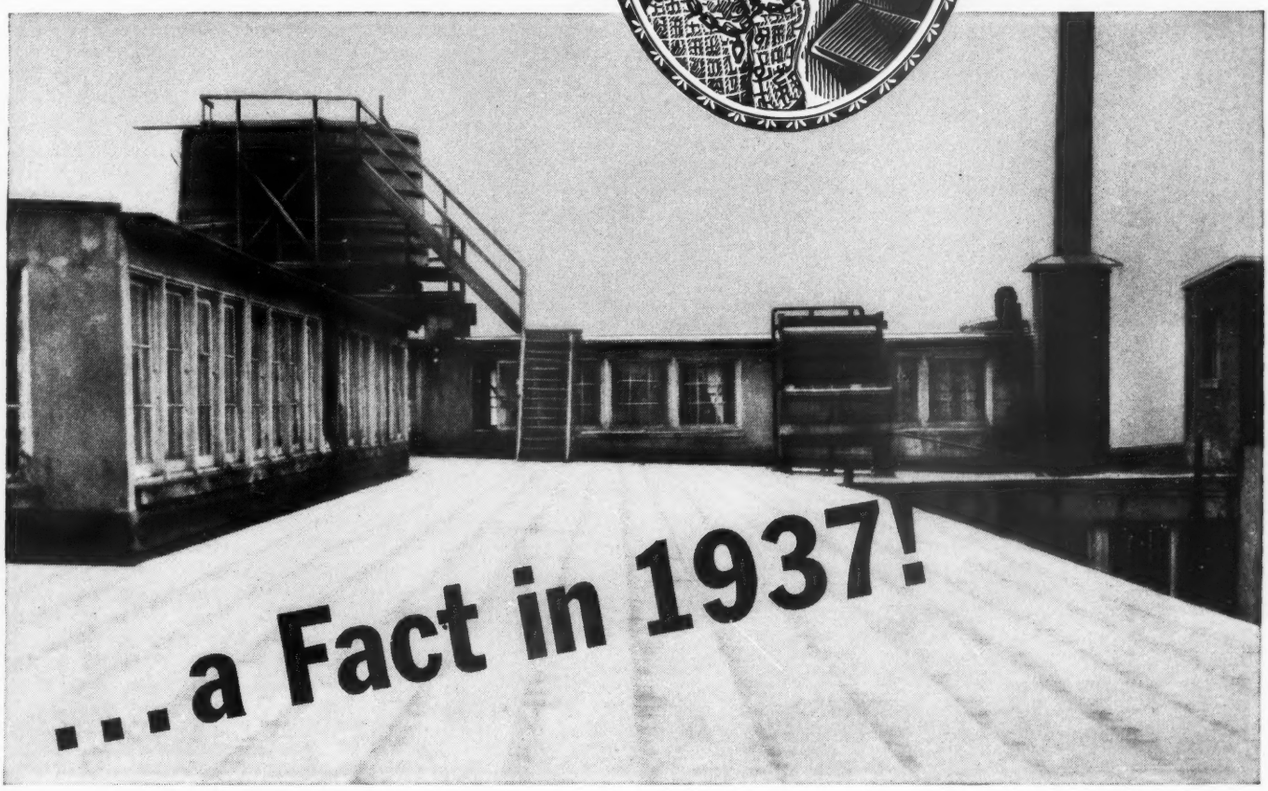
DAYTON Safety Ladder

(Patented)

Send for our new Catalog No. 5 showing a complete line of accident prevention equipment.

A Belief in 1912

It is my belief that our best assurance of roofing permanence at negligible upkeep is a J-M Asbestos Roof



...a Fact in 1937!

ANOTHER CASE HISTORY in the long, long list of success stories on J-M Asbestos Roofs . . .

It began in 1912, with the belief that such a roof would give this railroad shop building in Indiana lasting protection from the elements. In 1937, with years of satisfactory service still ahead, the belief has become most decidedly a fact!

And this is but one of many J-M Asbestos Roofs still in excellent condition as they near or pass the quarter-century mark. They give roofing permanence because *they are built up with felts made of the weatherproof, fireproof, permanent mineral—asbestos.*

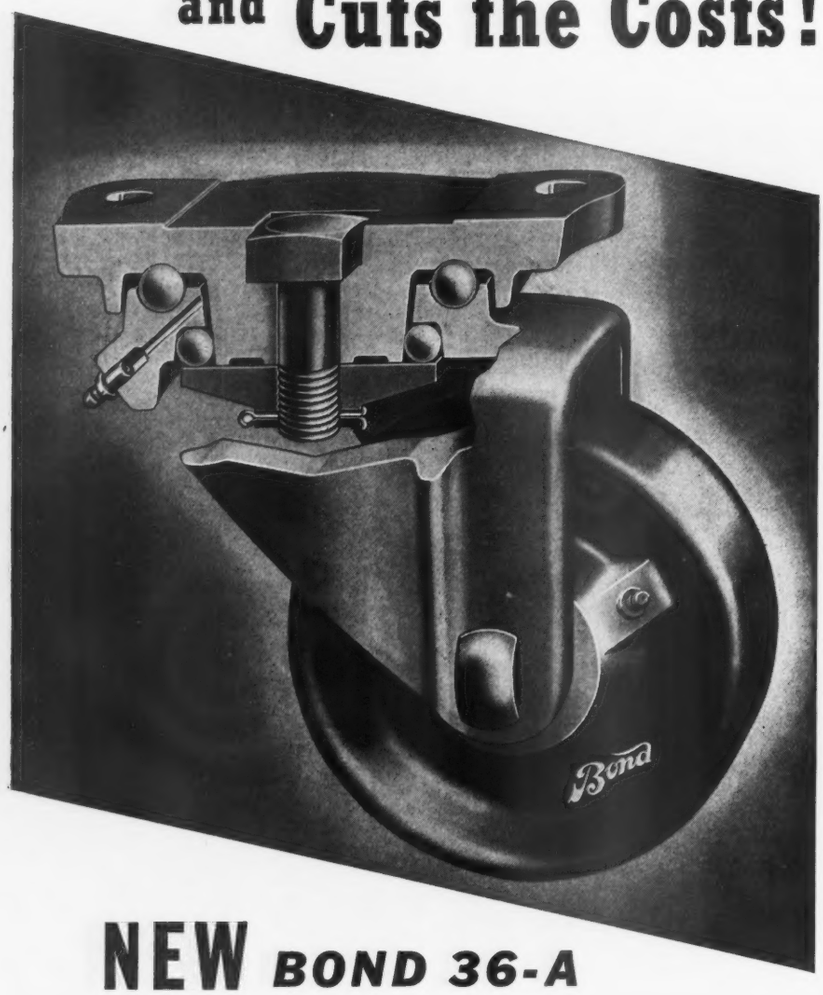
Furthermore, their construction is such that they provide maximum resistance to the intense drying-out action of the sun. A glance at the diagram and accompanying story shows why. And, if you wish complete information on all phases of built-up roof construction, complete details on all J-M Roofs, be sure to get a copy of our handbook, "Specifications on J-M Bonded Built-Up Roofs." Simply write to Johns-Manville, 22 East 40th Street, New York, N. Y.

How J-M Asbestos Felts Protect the Waterproofing Asphalts from the Sun

As this enlarged cross-section of a 3-ply J-M Asbestos Roof shows, each asbestos fiber is solid, non-capillary. The asphalt cannot penetrate into the fibers, *or be drawn up through them by the sun.* Hence, the asphalt—both within the felts and between the plies—retains indefinitely the lighter oils so essential to effective waterproofing.

Johns-Manville BONDED BUILT-UP ASBESTOS ROOFS

"Cuts the Corners" and Cuts the Costs!



NEW BOND 36-A

EASY SWIVELLING of Bond's New 36-A Truck Caster permits workmen to turn trucks on a dime—"cut the corners" in moving materials. Time and labor saved—plus the long life of this new caster—cuts costs. Bond's New 36-A is basically different in design. It combines long service with easy swivelling because of the arrangement of its ball races and its use of durable Bond Caster metal.

This caster is the latest example of Bond's "design for the job" policy. You need information about it. Easy to get—just write us for the new specification sheets—today, while you remember.

BOND FOUNDRY & MACHINE COMPANY
MANHEIM, Lancaster County, PENNSYLVANIA
617 Arch St., Phila.; 30 Church St., N. Y. C.
Bond Engineering Works, Ltd., Toronto, Can.

Bond
REG. U.S. PAT. OFF.
TRUCK CASTERS
Bond Power Transmitting Machinery delivers more power at less cost.

outlets or stations to give this motor counter-clockwise rotation. Then connect all of the equipment to rotate in the right direction from this standardized outlet. When making changes in wiring, or installing new stations, the electrician will need only the small motor to test the outlet. If the motor turns in the wrong direction, reverse any two leads to the outlet.

After standardizing the outlets, test the equipment to be operated; units that run backward may be reversed by changing any two leads at the motor or plug.

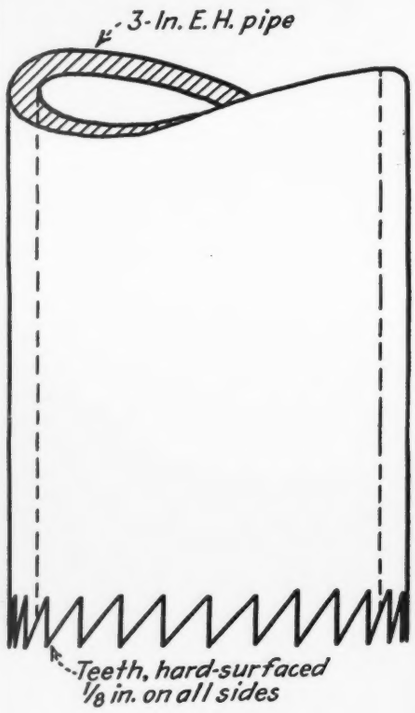
NORMAN C. MILLER, *Oberlin, Ohio*

Reader Wants Answer

Inspecting Control Equipment

Some of our control equipment has recently given trouble which seems to be due to lack of attention. I want to put control inspection and maintenance on a more definite basis, and wish that readers would tell me how often they inspect controls, and the routine they follow. I am particularly anxious to know what points should be most closely watched.

Most of our motors range from 2 to 5 hp., 440 volts, three phase, and are controlled by pushbuttons through across-the-line starters. Larger motors have compensators, mostly hand-operated. Six motors have full automatic starters which are operated by pressure switches. Service conditions are about the same as found in the average plant. —D.McD.



The **CHIEF ENGINEER**

"I prefer "Buffalo" Pumps for their well-balanced design, the precision used in every detail of construction, the rugged way they are built to do the job at hand."

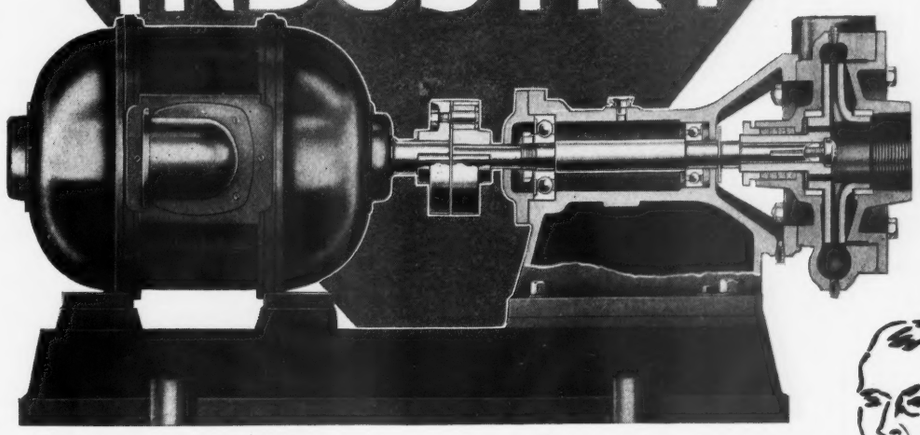
The **PRODUCTION MANAGER**

"Our shut-downs are few and far between since we installed "Buffalo" Ball Bearing Pumps."

The **PRESIDENT**

"The fine reports I keep getting from our staff on "Buffalo" Pumps fully satisfy me that they have been an excellent investment."

Approved BY THE KEY MEN OF INDUSTRY



The **SALES MANAGER**

"Thanks to "Buffalo" Pumps I can now promise better deliveries of our own products to our customers."

The **MASTER MECHANIC**

"I like the ease with which shells and side plates can be removed for access to the impeller."

The **TREASURER**

"Our cost records show that "Buffalo" Pumps operate more efficiently than any others we have ever used."

The **PURCHASING AGENT**

"My job is to get maximum value for every dollar we spend. That's why I like to sign purchase orders for "Buffalo" Pumps."

We shall be glad to send you literature on these Better Pumps for Industry.

BUFFALO PUMPS, INC.

471 Broadway, Buffalo, N. Y.

BRANCH ENGINEERING OFFICES IN PRINCIPAL CITIES • IN CANADA: CANADA PUMPS, LTD., KITCHENER, ONT.

"Buffalo" DOUBLE BALL BEARING PUMPS FOR EVERY INDUSTRIAL USE

Sayings and Doings

•

Mr. Lewis Speaking

This country probably will not feel the need of a dictator in the near future. If it should, there are several promising candidates for the job, not the least likely of whom is Mr. Lewis. Witness the technique of his chastisement of government and business.

To Mr. Roosevelt for having suggested that to some extent both sides might have been in error in a recent bloody strike experience, he said:

"It ill behooves one who has supped at labor's table and who has been sheltered in labor's house to curse with equal fervor and fine impartiality both labor and its adversaries when they become locked in deadly embrace."

To a congressional majority which refused to appear on the floor and pass a wage and hour bill to which Mr. Lewis himself gave only grudging lip-service support until after its failure was practically assured, he said:

"The spectacle of august and dignified members of Congress, servants of the people and agents of the republic, skulking in hallways and closets, hiding their faces in a party caucus to prevent a quorum from acting upon a labor measure, is one that emphasizes the perfidy of politicians and blasts the confidence of labor's millions in politicians' promises and statemen's vows."

He reminded the Democratic Party that it is on trial with these words:

"A political party which seeks the support of labor and makes pledges of good faith to labor must, in equity and good conscience, keep that faith and redeem those pledges . . . . Labor next year cannot avoid the necessity of a political assay of the work and deeds of its so-called friends and its political beneficiaries. It must determine who are its friends in the arena of politics as elsewhere."

To the United States Chamber of Commerce, the National Association of Manufacturers, to the Hershey farmers, to organized workers who prefer jobs to picket lines, Mr. Lewis had this to say:

"These groups are encouraging a systematic organization under the sham pretext of local interests. They equip these vigilantes with tin hats, wooden clubs, gas masks, and lethal weapons and train them in the acts of brutality and oppression. They bring in snoops, finks, hatchet gangs, and chowderhead cohens to infest their plants and disturb the communities. Fascist organizations have been launched and financed under the shabby pretext that the whole CIO movement is communistic.

"No tin hat brigade of goose-stepping vigilantes or bibble-babbling mob of blackguarding and corporation-paid scoundrels will prevent the onward march of labor."

Business Week

•

Industry's Objections to Undistributed Profits Tax

To assist in obtaining modifications of the undistributed profits tax on business and employment, the National Association of Manufacturers has filed with the Treasury Department an extensive survey of the effects of the law, based on letters from manufacturers from all parts of the country. It is hoped that amendments to the existing law will be submitted to Congress at the coming session, and that the tax adopted last year, which imposes a heavy penalty on net income not distributed as dividends will be lightened.

Ten general conclusions are made in the survey. They are:

1. Young, growing concerns and companies having large debts are seriously handicapped by the law, while strong

NO skidding from side to side, quick stops and sure starts—the same features which make Inland 4-Way Floor Plate safer underfoot make it also safer under plant haulage equipment. It is equally slip-proof in all directions.

Inland originated the 4-Way Safety pattern to provide greater floor protection against accidents, easy cleaning and extra stiffness to withstand heavy loads and hard wear. Write for our illustrated booklet on how to secure safer industrial floors.

INLAND STEEL

SHEETS • STRIP • TIN PLATE • BARS • PLATES • STRUCTURALS • PILING • RAILS AND ACCESSORIES

INLAND STEEL CO.

General Offices: 38 South Dearborn Street, Chicago, Illinois • Offices in: Detroit Kansas City Milwaukee St. Louis St. Paul

Study your operating conditions before you install a lighting system

WHEELER REFLECTORS

make PLANNED LIGHTING profitable because

when installed in accordance with engineered recommendations, fitted to your specific lighting requirements, doubtful results are eliminated.

All industrial lighting problems can be solved by the correct selection and proper installation of good lighting equipment. By Correct Selection, we mean type, shape, size and number of lighting units required. By Proper Installation, we mean scientific placement and spacing of the selected lighting units.

Wheeler Reflectors are scientifically designed for use with modern lamps. In shape and in light output they have been designed to produce the greatest amount of useful illumination at any working plane. There is a type of Wheeler equipment that will meet every lighting requirement in your plant.

WHEELER REFLECTOR CO.
275 CONGRESS ST. BOSTON, MASS.
ATLANTA NEW YORK CLEVELAND TORONTO

You may want advice or assistance on some installation you are now planning. If you do, an experienced Wheeler engineer will be glad to help you. A complete engineering service—including planning, recommendations and blue print layouts—is at your disposal. In the meantime, we have available a new and very complete Lighting Manual containing a great deal of information that will be helpful to you.

Send for your Lighting Manual today!

WHEELER REFLECTOR COMPANY
275 Congress St., Boston, Mass.

Please send a copy of your new 200-page LIGHTING MANUAL.

Name ..... Title .....

Company .....

Address .....

City ..... State .....

All Cats ARE GRAY IN THE DARK

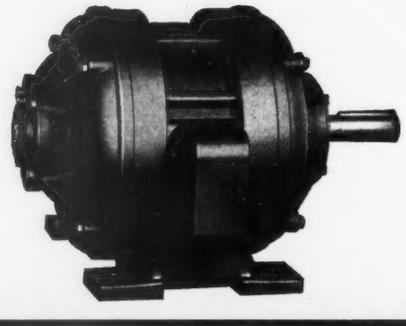
. . . but most motors look alike even in daylight. However, there are as great differences in the sturdiness of motors as there are in the color of cats. It is sturdiness that prolongs the life of a motor and reduces maintenance costs and Allis-Chalmers Motors are the sturdiest motors on the market—bar none.

Do you want to prove this to yourself?

Then don't just compare dimensions and electrical characteristics, for they are identical in most motors; prices are also about the same. It is the workmanship, the materials and the construction of motors that you should examine carefully, critically, before purchasing.

Careful examination of Allis-Chalmers Motors will reveal: ample insulation, with a big margin added for mechanical durability . . . studied use of steel throughout . . . cast steel frames . . . rugged cast iron housings . . . heavy bearing enclosures—that is why they are so sturdy. That is why they are the best motor buy on the market.

For further information write for Bulletin No. 2173.



The Allis-Chalmers Mfg. Co. builds standard motors of every type from 1 hp. up—also motors for special application

746

MOTOR DIVISION

ALLIS•CHALMERS

MILWAUKEE WISCONSIN

companies are in a more advantageous position.

2. Partnership form of business enterprise has an advantage over corporate form.

3. Companies faced with bond retirement and note payments as well as repayment of bank loans are discriminated against by narrow provisions of the law.

4. Where operating losses and deficits have impaired capital structure, companies are kept from paying dividends and are handicapped in restoring depleted capital.

5. Large commitments and outstanding loans show small prospect of early repayment, so customers will hesitate to incur capital goods investment.

6. Industries operating on cycle of profitable and losing years are confronted with serious reduction of working capital. Complicated task of ascertaining earnings makes dividends hazardous.

7. Forced distribution of earnings to avoid tax has caused bank loans and other unnecessary financing.

8. Complexity of tax structure raises problems of compliance as well as enforcement.

9. Formerly retained earnings built reserves which aided in stabilizing and increasing employment. The penalty tax tends to limit reserves and adversely influence the stability of employment as well as the creation of further needed employment.

10. Contemplated expansion programs have been delayed or abandoned since the penalty tax has made capital goods expenditures prohibitive in costs. These delays and stoppages of expansion serve to impede and curtail the reemployment that would result both directly and indirectly, from reequipment and expansion of plants.

•

Can We Afford It?

It is probably time for us to consider, as the French have had to do, whether we can afford at once all of the reform we have talked about and still continue to live in the style to which we have been accustomed. It is encouraging, at any rate, that a considerable number of Administration officials are beginning to ask themselves that very question.

RAYMOND MOLEY in *News-Week*

•

Green Holds CIO Invites Dictatorship

William Green, president of the American Federation of Labor, in his Labor Day speech denounced CIO as Labor's foe. He said in part:

The right to strike must be preserved and protected as a part of democratic procedure and democratic administration. We cannot surrender this right. Labor must always be accorded the right to resist injustice and to strike for the redress of wrongs when the conditions of employment become intolerable and unbearable. This involves the right to refuse to work, to enlist the support of fellow-workers and friends in the conduct of a strike, to picket and boycott legally and to use all legal and lawful methods in the conduct of a strike.

But, when property is illegally seized and held, labor subjects itself to the charge of lawlessness and the destruction of property. That means that labor places itself outside the pale and protection of law and lawful procedure. It is then subject to the charge of attempting to secure the redress of economic and industrial wrongs through the use of illegal methods. Public opinion, which is the most powerful force in American life, turns against it. When this occurs any temporary advantage gained must inevitably result in a permanent injury.

The application of the sitdown strike on a wide national basis would pave the way not to the establishment of a communistic State but to a Fascist dictatorship. No working man or woman would knowingly contribute toward such an outcome because individual freedom and liberty depend upon the preservation of democracy and our democratic form of government.

A Minor
OPERATION
. . . often eliminates
MATERIAL
HANDLING
PROBLEMS
BELT CONVEYOR
SLAT CONVEYOR
TROLLEY CONVEYOR
CHAIN CONVEYOR
OVEN CONVEYOR
GRAVITY CONVEYOR
DOES the efficiency of your material moving equipment vary in different departments—does it require pampering—do handling costs cripple production? If any of these conditions exist, good business demands their immediate rectification—often only a minor operation. The Jervis B. Webb Company build and furnish every type of conveyor and have the knowledge and experience to operate on every material handling problem and correct it in the most economical manner.
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Conveyor Engineers and Manufacturers
WEBB
8951 Alpine Avenue • Detroit, Michigan

Letters from the Editor

Dear Mr. W———:

Thank you for your comment to the effect that *Factory*, by its editorials, has tended to increase antagonism between labor and management, and that we are, therefore, at least inconsistent in saying that in the interest of prosperity there must be harmony between the two.

It is the belief of *Factory*—and I feel that our published statements have expressed this belief—that there must be harmony in the relationships between management and labor. But it is also our belief that legislation, and not *Factory's* statements, have tended to arouse class feeling. The Wagner Labor Law, for example, states that its objective is harmony in industrial relations, and we have no doubt that the objective was correctly stated. However, we feel that the law as written tends to defeat rather than attain the objective. That has been our stand in *Factory*. It is typical of our stand on many matters of legislation, and we feel that we are consistent in agreeing with objectives while we object to the means proposed to attain them.

As I go back over the volumes of *Factory* I find a long list of articles addressed specifically to management, suggesting ways and means by which management can improve its relationships with labor. They all look toward the mutual benefit of the two forces. To be sure, most of them are based on the premise that it is to management's self-interest to follow the proposals. There is nothing the matter with self-interest so long as it does not become pure selfishness, with detrimental reaction to one or more of the contributory factors.

Our whole stand has been based on the economic philosophy that everything possessed by the people of the United States comes out of production. In other words, the standard of living of the country is controlled by the goods and services produced by industry. Those goods and services must therefore be produced at the lowest cost in order to obtain the widest distribution. But wide distribution depends upon proper distribution of the value of the goods and services (by means of wages, salaries, and dividends) in order that the goods and services may be purchased. We certainly quarrel with the theory that purchasing power can be increased by legislation—in other words, that the power behind distribution can be created ahead of the production of the wealth itself.

I hope that these statements explain why *Factory* has stood against one-sided legislation, usurpation by strikers of control over the rights of non-strikers and the public, and similar conditions and occurrences. It seems to me that they conflict in no way with the rights of collective bargaining, and of peaceful picketing, and that they indorse the ideal of the wide distribution of industry's goods and services in the interest of a higher standard of living for everyone.

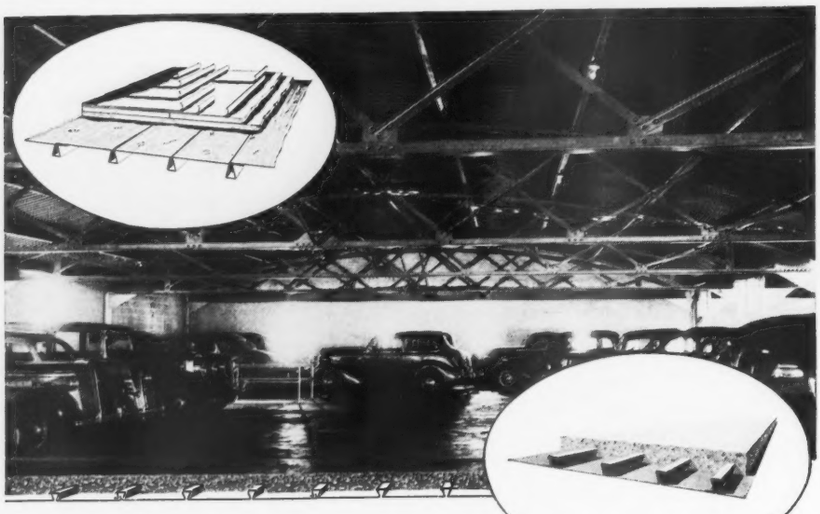
Dear Mr. S———:

In reply to your inquiry about employee suggestion systems, I am first of all sending copies of one or two articles we have published.

Then I suggest that you write to the Metropolitan Life Insurance Company and get a copy of a booklet they published a year or so ago. It is called "Employee Suggestion Systems."

Next, write to the University of Michigan and get a copy of Michigan Business Studies, Vol. I, No. 3. This is a study of suggestion systems made in 1927. It is 10 years old, to be sure, but you will nevertheless find it useful.

Last, get a copy of the Bibliography of Management Literature published by the American Society of Mechanical Engineers. You will find a good many references in it to suggestion systems.



ABOVE . . *it has a Holorib* ROOF
BELOW . . *it has a Holorib* FLOOR

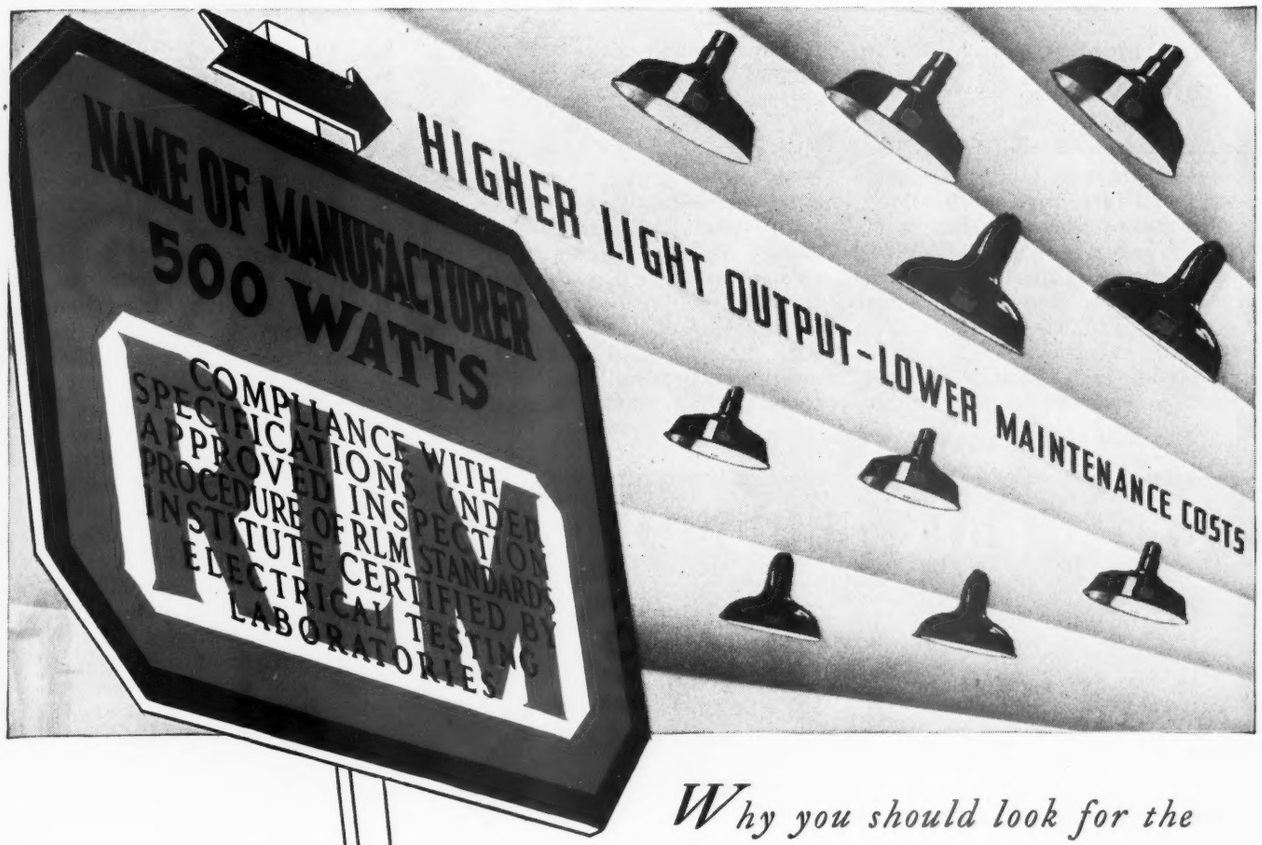
In the Olds Garage in Lansing, Michigan, Holorib does double duty. On the roof purlins, spaced 5'6", it is a light, tight, durable steel base supporting insulation and waterproofing. It provides a long-lasting protection at minimum initial cost and practically no maintenance expense.

Under the floor, on steel beams, spaced 4'0" apart, Holorib (with ribs turned up) acts as a permanent steel form and automatic reinforcing for 3" of concrete which daily withstands the wear and vibration of heavy cars and trucks.

Many practical minded designers of industrial and commercial buildings have found in Holorib, the self-reinforced steel sheet,—a convenient and economical answer to troublesome and expensive roof and floor problems. Perhaps it can assist you, too. The nearest Fenestra representative will be glad to furnish detailed information. A new 8-page engineering manual on Holorib Floor Form Construction, will be sent on request.

DETROIT STEEL PRODUCTS CO., 2258 E. GRAND BOULEVARD, DETROIT, MICH.

Fenestra HOLORIB
ROOF DECKS FLOOR FORMS



Why you should look for the RLM LABEL *on your Lighting Equipment*

Lighting reflectors may look alike but as with every other type of product they differ as to quality and efficiency. These differences are important, yet usually can only be detected by exacting laboratory and engineering tests not readily available to those who purchase and specify lighting equipment. Therefore, the RLM LABEL!

The RLM LABEL is a certificate of uniform quality and a warranty of conformance to certain high quality standards established by the RLM STANDARDS INSTITUTE. It is the buyers' guide post to higher lighting efficiency and lower operating and maintenance costs!

Basically the RLM LABEL stands for:

1 MORE LIGHT AT NO EXTRA COST
Efficiency specifications are 10-12% higher than average reflector efficiency.

2 BALANCED LIGHTING
Proper distribution and adequate diffusion are just as important as the amount of light. RLM Specification Porcelain Enamel has no known equal as a reflecting surface for Balanced Lighting.

3 LOW REPLACEMENT & MAINTENANCE COST
RLM Specification high quality porcelain enamel is the most durable of all reflecting surfaces. Being easier to clean, maintenance costs are reduced to a minimum.

4 UNIFORM QUALITY
To insure uniformity of quality and conformance to RLM Specifications, inspections and tests are continuously conducted by the Electrical Testing Laboratories of New York, an independent Testing Organization.

For further information about RLM Reflectors and a copy of the RLM Standards Specifications for Dome Reflectors, you are invited to communicate with any of these manufacturers of RLM Standard labeled reflectors. The letters RLM mean Reflector and Lighting Equipment Manufacturers.

ABOLITE REFLECTOR COMPANY
West Lafayette, Ohio

BENJAMIN ELECTRIC MFG. CO.
Des Plaines, Illinois

GOODRICH ELECTRIC COMPANY
Chicago, Illinois

THE MILLER COMPANY
Meriden, Connecticut

OVERBAGH AND AYRES MFG. CO.
Chicago, Illinois

QUADRANGLE MFG. COMPANY
Chicago, Illinois

SMOOT HOLMAN COMPANY
Inglewood, California

WESTINGHOUSE ELECTRIC AND MFG. COMPANY
Cleveland, Ohio

WHEELER REFLECTOR CO.
Boston, Massachusetts

RLM STANDARDS INSTITUTE
INCORPORATED

THE CERTIFICATE OF RLM UNIFORM QUALITY

Power Trucks in Tight Places

(*Continued from page 83*)

system to permit easy interchange among the three main systems.

The motive power consists of six high-lift electric trucks. On two of the main routes, and on the interconnecting route, this equipment is used in conventional fashion to handle skids, boxes on skids, skids with casters, and so forth.

It is noteworthy, too, that we are able to use two-way rather than four-way entry skids. This meant that we did not have to replace the several thousand two-way entry skids we already had. With conventional 90-deg. loading, four-way entry skids would have been essential. And the cost of replacing two-way with four-way skids would have almost doubled the investment required for installing the new centralized trucking system.

Our present skids were usable with the new trailers and we would not have to invest in the conventional rolling platforms used with plain drawbar tractors. A skid of the type we use costs us approximately $3 to build, and we already had plenty of them. A trailer of similar capacity would cost from $35 to $60.

Another advantage of the skids is that in the main aisles, where we have loading zones 10 ft. wide, the operator double-decks the skids. The two-layer load rides with so little sidesway that it is safe from danger of toppling.

The trailers are swivel-topped. Three trailers constitute our train. When the train of trailers is uncoupled from the truck and ready for loading, the trailers stand with the swivel tops—the trailer beds on which the loads rest—swung out at a 40-deg. angle. The truck is then used to pick up a loaded skid. The load platform is elevated to a definite level shown by two indicators, one on the elevating chain, the other on the upright of the truck. When these are exactly opposite each other, the load platform has reached the desired elevation.

Sets Skid on Trailer

The truck is then brought into a position at a 40-deg. angle where the loaded skid can be set on the swivel top of a trailer. By lowering the platform to another indexed point, the operator sets the loaded skid on the trailer. The truck platform is now free and ready to be withdrawn.

This procedure is repeated until each trailer has been loaded. The operator picks up an additional skid on the platform of the truck and elevates the platform to the third indexed point.

Remember, the trailers are all in line as part of a coupled-up train; only the swivel tops assumed the 40 deg. angle. With his electric truck approximately in line with the trailers and a load on its platform, the operator cannot see the front end of his truck. But he can couple up blind.

When the platform of the truck has been lowered to the correct point and is in position for travel, the operator starts his truck. The truck pulls the towing hook and drawbar forward, and through a mechanical arrangement operates a group of levers which swing the tops of the trailers through a 40-deg. angle into closed position.

The operation of swiveling the loads into the closed traveling position occurs while a self-energizing brake engages the rear wheels of the front trailer. This brake pre-

UP-TO-DATE PRODUCTION!
The correct oil film to each individual bearing... automatically
"V & O" Power Press
BIJUR
AUTOMATICALLY Correct LUBRICATION
● Bijur automatic lubrication . . . an essential development in the revolutionizing of machine tool operating efficiency . . . is now standard equipment on power presses. Heavy loads, high speeds, demand positive lubricating equipment . . . Bijur centralized, force-feed, controlled lubrication. No bearing neglected. Each fed the correct oil film required, under all operating conditions. Shut-downs avoided . . . tight production schedules upheld For low-cost maintenance, big-volume production, insist on BIJUR-EQUIPPED machines.
BIJUR LUBRICATING CORPORATION LONG ISLAND CITY NEW YORK
890

Stop costly "HIDE AND SEEK!" use INDICATOR FUSES

Built-in "Sentry Light" spots the blow instantly!

Approved Underwriters' Laboratories

Forget test lamps . . . production delays! Built into every Indicator Renewable Fuse is an exclusive *Sentry Light* that glows the instant a short or overload occurs . . . shows at a glance "which fuse blew" . . . speeds re-fusing.

Indicator Renewable Cartridge Fuses are quickly removed and easily renewed. The shock-proof handle enclosing the *Sentry Light* is an ever-ready fuse puller. Minimum loose parts simplify reloading. Extra-heavy gauge fibre and brass resist more blows—insure longer life.

Indicator "6" Multiple Plug Fuse is the only fuse with six lives and the exclusive *Sentry Light*. Can be used six separate times without removal from socket. Should the fuse blow, the *Sentry Light* glows and is easily detected. Turn handle one notch to right . . . *Sentry Light* goes out . . . new fuse comes in.

Write Department 202 for folder containing full details about complete line of Indicator Fuses.

INDICATOR CORPORATION

32-36 GREEN ST. NEWARK, N. J.

THE FUSE WITH THE "SENTRY LIGHT"

Figure Your Painting Cost ON THE FINISHED JOB... Not on the PRICE PER GALLON OF THE PAINT!

CHECK the five points listed across the page and you'll see the logic of using the best paint available to do your job at least expense. And if you want statistics, write for a copy of "More Light with Lasting Cleanliness" . . . it's the real answer to your painting problem. U. S. Gutta Percha Paint Company, 19 Dudley Street, Providence, R. I.

FINISHED COST of a paint job is what really counts . . . not the price per gallon of the paint. And finished cost can be measured only on the basis of five vital qualities . . . initial whiteness . . . lasting whiteness . . . spreading power . . . hiding power . . . ease of flow.

BARRELED SUNLIGHT, the only white paint possessing ALL FIVE of these important characteristics, assures a cleaner, more economical, more efficient job —a substantial saving in painting time and labor—a far more permanent white finish—and a definite downward trend in your painting budget.

BARRELEDS

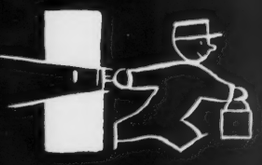
1 WHITEST

greater in light-reflecting power

2 WHITE LONGER

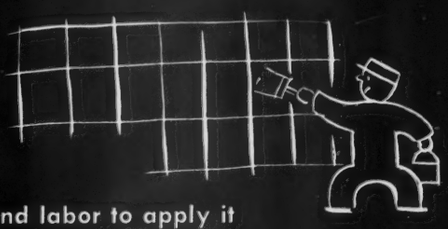
danger of "yellowing" greatly reduced

3 HIDES BETTER



often one coat covers where two of ordinary paints are necessary

4 SPREADS FARTHER



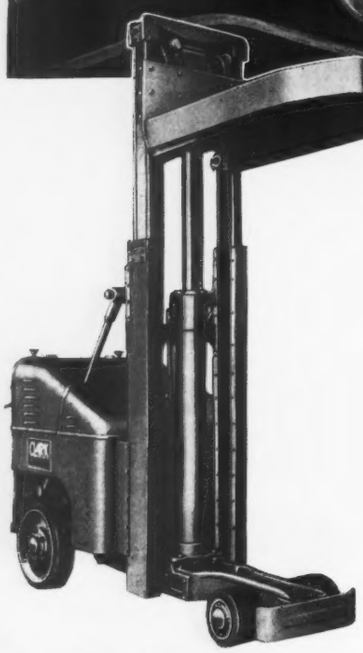
less paint for job . . . less time and labor to apply it

5 FLOWS MORE EASILY

a quicker job . . . less expense for time and labor

SUNLIGHT

This 3-ton Clark Finger Lift Truck totes a mean load—6,000 lbs. 25 in. in front of vertical plate. Lifting range, 2 in. to 50 in.



Clark Telescopic Platform Truck with rear wheel drive, 4-wheel steer, 3-ton lifting range from 11 in. to 102 in. Turns in intersecting 64 in. aisles.

Lifting
Tilting
Toting
Tiering

CLARK

New stamina, new power, new ease of operation will be found in the new line of "Clark" machines. Powered with 6-cyl. commercial truck engines they're good for continuous 24-hr. service. Available in a wide range of models—platform and finger lift—many telescopic—each one operates on a minimum budget for fuel, lubrication and upkeep through a long, busy, useful life. Ask for catalog.

CLARK TRUCTRACTOR
Div. of Clark Equipment Co.
Battle Creek, Michigan

Direct Gas Powered
—always. Since 1917

vents forward motion of the trailers while the truck is swiveling the loads. During the last half-inch of travel of the drawbar, the brakes are released.

The pull of the electric truck is transmitted to the frame of the first trailer and then by semi-universal couplings to the second and third trailers. The cable used to swivel the tops of the trailers into closed traveling position does not serve to move the trailers forward in travel. A mechanism prevents the trailers from swiveling into open position when the electric truck slows down or stops.

When the train reaches a destination, the operator raises his load platform, and the towing eye is drawn up and off the towing hook. This operation also sets the brakes and swings the swivel tops of the trailers out at a 40-deg. angle. The train is then ready for unloading and reloading.

Repeated mention has been made of our narrow aisles. We had to widen them only to accommodate the short loading and unloading zones, and cut back some corners.

Hot Spots for Rush Jobs

At each shipping and receiving zone is one small area painted red and known as the hot spot. Rush items are placed here. Anything on a hot spot has priority over everything else on that trip.

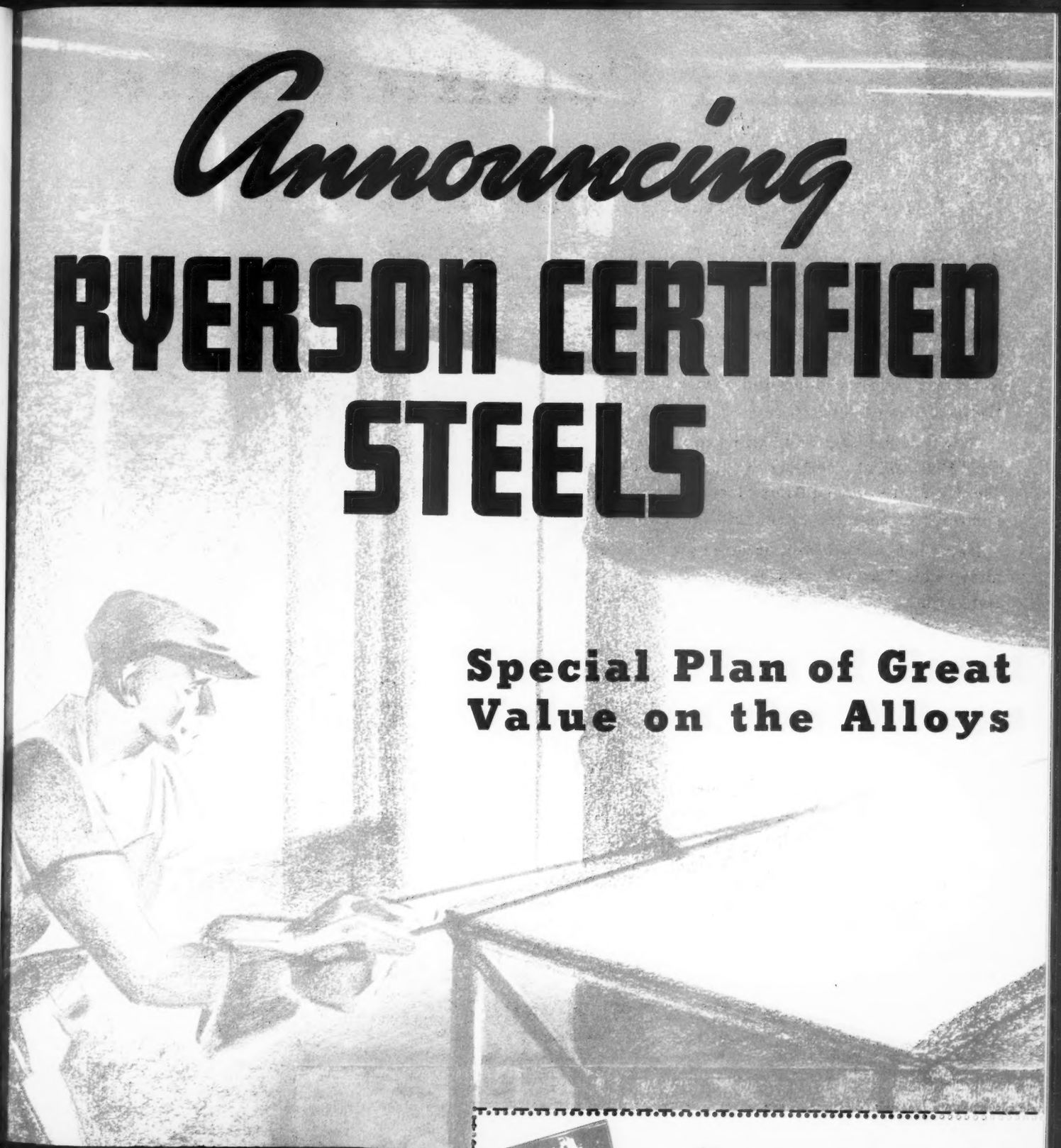
Shipping instructions are simple. A department having material to be transferred to another department marks the address on a carton of purchased material or places a piece of paper bearing the destination department number on the top of a miscellaneous load. Manufactured parts are moved according to instructions on "Transfer Tickets," which give the destination. Truck operators keep a record of the number of loads moved, and this record enables us periodically to review the volume of traffic chargeable to a given department.

On one route we have two lift trucks and two operators. On each of the other three routes, we have one man and one truck; one of these trucks is the motive power of the tractor train. Likewise, we keep one utility truck and operator. Four of the trucks are indexed so that they can be used to pull the train.

On the night shifts, with lessened activity, we get along with a smaller transportation corps and consolidated routes. On the day shift, when a truck operator observes a congestion on an intersecting route, or when he is told of it by his

Announcing

RYERSON CERTIFIED STEELS



Special Plan of Great Value on the Alloys

Booklet explains this unique service. Use prepaid card for your copy.

Send me your new book C 4 on Ryerson Certified Steels. ☐

I am interested in the following

_____

_____

_____

My Name _____ Position _____

Company Name _____

Local Address _____

City _____ State _____

Ryerson Certified Alloys

Principal Feature of Plan

RYERSON has always carried only the higher quality steels in every class. For instance our structural steel all meets A. S. T. M. specification for bridges with 60,000 lbs. minimum tensile strength. Mild steel bars are specified to ladle analysis S. A. E. 1020 with low carbon within a 5 point range. Only prime quality sheets are carried. Special specifications and rigid checking and inspection methods protect users of all Ryerson steel products.

Now Ryerson takes another big step forward with a new Certified Alloy Steel Plan and also certifies the quality of all other steels carried in stock. The Ryerson Certified Alloy Steel Plan assures greater uniformity; helps secure better heat treatment results; and eliminates much costly testing.

Never before could you be sure how different bars of standard analysis alloy steels drawn from warehouse stock would react to heat treatment. Bars of the same standard S. A. E. specification from different heats may vary greatly in hardening characteristics even though they are well within the range of the standard specification.

Now Ryerson brings you steels from selected heats in which the hardening factors (analysis, grain size, etc.) are held in a narrow range to give more uniform heat treatment response.

With each order purchased, Ryerson furnishes a report giving the analysis and heat treatment characteristics of the steel furnished. Users of Ryerson Certified Alloy Steels do not have to run expensive analysis or hardening tests on each bar, as they know from what heat the bars are rolled and how that particular heat will react to heat treatment.

You will find many advantages in the use of Ryerson Certified Steels. Let us tell you the complete story of how Ryerson can offer you such an outstanding steel service. Write for booklet. The post card below requires no postage.

JOSEPH T. RYERSON & SON, Inc.

Chicago	Milwaukee	St. Louis	Cincinnati	Detroit
Cleveland	Buffalo	Boston	Philadelphia	Jersey City

Certified Stocks Include

Hot Rolled Alloys

S. A. E. 2315, 2320, 2330, 2335, 2340, 2345, 2350, 3115, 3120, 3130, 3135, 3140, 3250, 4140, 4615, 6145, 52100; Rycase (hot rolled, machine straightened); Rytense A. A. (hot rolled, machine straightened).

Cold Drawn Alloys

S. A. E. 2315, 2320, 2330, 3115, 3120, 3135, 3140.

Heat Treated Alloys

Ryco (hot rolled, machine straightened); Rycrome (hot rolled, cold drawn, machine straightened); Nikrome "M" (hot rolled, machine straightened); Ry-Ax and Ry-Arm (hot rolled, machine straightened).

Stainless

Allegheny Stainless Sheets, plates, rounds, squares, hexagons, flats, angles, pipe, tubing, bolts, nuts, etc., in a variety of finishes.

Cold Finished Steels

Standard Shafting; turned ground and polished; Special Accuracy Stock; Rycase High Manganese Screw Stock; S. A. E. 1020, 1035, 1112, 1120, etc.

Tool Steels

Ryerson B. F. D. Die Steel; Ryerson "Shock" Steel; Ryerson V. D. Steel; Ryerson High Speed Tool Steel; Ryerson Special High Speed Tool Holder Bits; Ryerson Carbon Steel Drill Rod.

Special Sheets

21 special quality sheets. Also all standard sheets such as plain black, galvanized, corrugated, etc. *Only Primes* are carried by Ryerson.

General Steel Products

Beams; Channels; Angles; Tees; Zees; Plates (17 kinds); Spring Steel; Tire Steel; Refined Iron; Boiler Tubes and Fittings; Bolts; Screws; Nuts; Washers; Rivets; Nails; etc.

Floor Plate, Stair Tread

Inland 4-Way Floor Plates and Traffic Plates; Firm-tread Diamond Pattern Floor Plate and Traffic Plates; Mason Safety Treads, etc.

Welding Equipment

19 Kinds of electrodes including improved stainless steel rods, shielded arc type rods, and special processed rods. 8 kinds of acetylene rods. Also welding accessories.

Building Products

New billet and rail steel reinforcing bars, spirals, electrically welded wire fabric, expanded metal, reinforcing mesh, caisson rings, sheet piling, bank vault reinforcing, safety treads, etc.

Allied Products

Ryertex Bearings, Babbitt Metal, Solder, Flux, Curb Strip, Wire and Wire Rope, Chain, Slings, Slip and Grab Hooks, etc.

Write for the Ryerson Stock List

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

FIRST CLASS PERMIT No. 143, SEC. 510 P. L. & R. CHICAGO, ILL.

JOSEPH T. RYERSON & SON, INC.

LOCK BOX 8000-A

CHICAGO, ILL.

PREPAID CARD BRINGS ILLUSTRATED BOOKLET

LINCOLN LUBRICATING EQUIPMENT Helps Steel Mill Solve Problem of Properly Lubricating Mill Rolls

● Have you ever watched red hot steel being shaped by passing through a rolling mill? It is interesting—and so is the way that Lincoln Industrial Lubricating Equipment is utilized to properly lubricate mill rolls and keep 'em rolling.

In the installation shown above a Lincoln Lubmaster Model 292 (shown below at right) is connected to lubricant lines which in turn lead to the system of lubricant injectors connected to the mill rolls. By means of an automatic timing mechanism, lubricant is applied to the bearings at frequent, regular intervals. The frequency may be adjusted over a wide range.

APPLICABLE TO ALL INDUSTRIES

Steel mills, however, are by no means the only places where Lincoln Equipment is being used to properly lubricate bearings and other moving parts. Today Lincoln Lubricating Equipment is being used in mills of all kinds, factories, mines, roundhouses, on contractors' equipment, on farm implements, in the oil fields, etc.

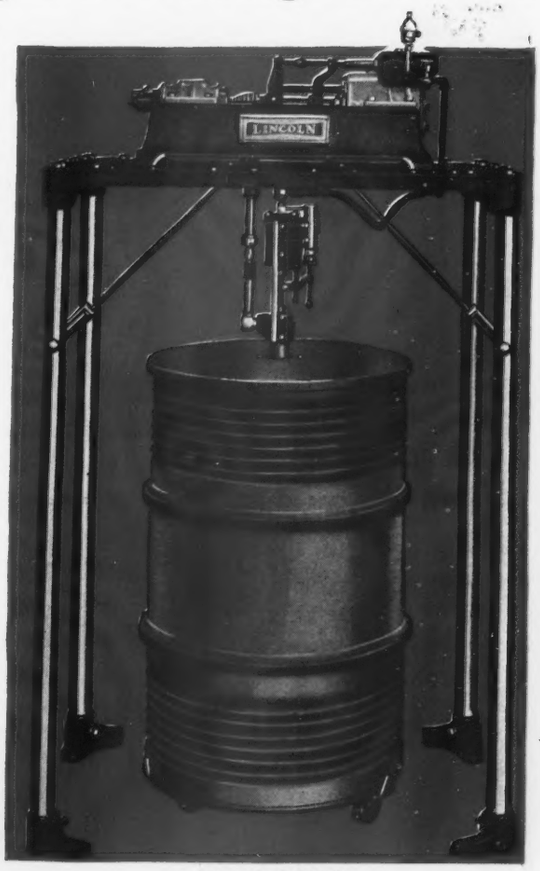
The complete industrial line manufactured by Lincoln includes lubricant dispensing equipment ranging from small hand guns to heavy duty power operated equipment such as Model 292. It also includes Lincoln KLEENSEAL and Button Head Fittings in all types and sizes to meet replacement and modernization needs.

HOW ABOUT *YOUR* MILL OR FACTORY?

You can avoid expensive bearing failures and shut-downs by utilizing Lincoln Equipment to properly lubricate the machinery in *your* plant.

Get complete information by requesting a copy of Catalog No. 60. It includes just the equipment you should have to help lower maintenance costs.

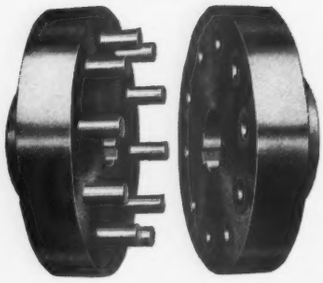
LINCOLN ENGINEERING COMPANY
PIONEER BUILDERS OF LUBRICATING EQUIPMENT
GENERAL OFFICES: ST. LOUIS, MO. FACTORIES: ST. LOUIS, MO., DETROIT, MICH.

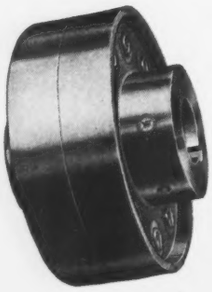


Lubmaster Model 292

INDUSTRY HAS A HUNDRED USES
For This New U.G. Flexible Coupling

STEEL PIN TYPE
RUBBER-BUSHED
WITH SELF-LUBRICATING
BRONZE BUSHINGS INSIDE THE
RUBBER





WOOD'S new Universal Giant "E" Flexible Coupling is of the steel pin, rubber-bushed type, with self-lubricating bronze bushings inside the rubber bushings. Pins float free without chafing the rubber . . . and, because they're all fitted to one flange, they're easy to remove to renew bushings, *it is not necessary to move the flanges on the shafts or to shift the shafts.*

Furthermore, this coupling not only affords *flexibility in all directions,* but *compensates for end float of motor shaft—provides excellent shock absorbing qualities,* and *acts as an insulator between shafts.*

Write for details and prices.

T. B. WOOD'S SONS CO.

50 Church St. New York City
CHAMBERSBURG, PA.
387-391 Atlantic Ave. Boston
MEMBER: The Mechanical Power Engineering Associates

NO BLOWING - NO BRUSHING - NO DUST.

In hundreds of places in industry, dust, shavings, or small particles of material must be removed during the process of manufacture. Vacuum does this quickly, with thoroughness and safety, and at less cost.

Put in a Spencer Vacuum line and see what happens. You will find a dozen ways to make it pay, and at the same time, improve the general dust condition in your plant.

Spencer Central and Portable Systems are available in all sizes, with tools for all conditions.

Let our industrial specialist look over your plant and tell you what others have done under similar conditions.

CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS

SPENCER
HARTFORD

THE SPENCER TURBINE COMPANY
HARTFORD
CONNECTICUT

S-96-B

foreman or by the other operator, he frequently finds it possible to leave his own route to clear up the overload. When he find himself swamped, the other fellow may come along and help him clear up. But in general the trucks stay on their own routes.

When we had determined on the method of handling our transportation system, and while the equipment was being finished, we did all of the preliminary preparation of widening doors, establishing freight and transfer stations, painting arrows on the aisles to show directions of movement and so forth.

Ready to Go

When the trucks and trailers arrived. we had our truckers all picked out and given the medical examination we require. Each man had to pass examination for reflex time, sight, hearing, etc. We put these men on the job one evening on a long shipping platform not required by the night shift, and trained them to operate the equipment.

For some little while previously we had been talking over the idea of a central transportation department with our foremen, and they were all accustomed to the idea and a little impatient for it to start. Two men, an engineer and an assistant, took over the job of installation; they had done the preliminary planning and training also.

They went to each foreman on a route, said, "We'll handle these jobs for you." The jobs were taken over a few at a time, and for days the aisles contained both hand and electric trucking. But the shift-over went without a hitch, simply because the preparation had been thorough and because there was no effort to bite off the entire job in one piece. The shift-over on each route took about a week or ten days, and the routes were taken over one at a time.

The engineer and his assistant stayed on the job, sometimes all the way around the clock, until they had each route ironed out. When it was finally working smoothly, the assistant became foreman of the Centralized Trucking Department, where he has functioned ever since.

Each department still has its own internal trucking to do, and this is handled as before by whatever type of hand equipment fits it best. The men on these jobs are known as departmental truckers. They move material on short hauls where manual handling makes for common

Goodrich Rubber-Tired Wheels

STOP NOISE · SAVE TIME · SAVE MONEY

STEEL wheels on trucks and trailers mean higher costs, dollars that can be saved. Trucks crunch and splinter floors, require more power, travel slowly.

The clattering, clanking, crashing noise confuses workers, disturbs and distracts them. Work is slowed up.

You can easily get away from all this. Changing from obsolete steel wheels to rubber-tired wheels is simple and inexpensive. Rubber absorbs the bumps, cushions heavy loads, yields to hammering shocks. Goodrich rubber-tired wheels will silence the disturbing din. You will make big savings—enough so that the rubber tires will pay for themselves.

Consider what they can do for you:

1. Save floors. 2. Save time. 3. Check accidents. 4. Prevent breakage. 5. Save power and human energy. 6. Save depreciation on equipment. 7. Eliminate noise and vibration.

Call this Man

A Goodrich engineer will make a survey of your particular needs. He will analyze your floor conditions, operating speeds, loads, etc. Then he will recommend the proper size and type of wheel and tire for your needs and tell how little it will cost to start saving. It will pay you well to get these facts. Call the Goodrich man today—or mail the coupon below.

This GOODRICH Vulc-On Wheel Pays Its Own Way

Goodrich
Industrial
Tires

The B. F. Goodrich Co. Dept. N-46
Akron, Ohio.

Gentlemen: Please mail me (without obligation) your booklet on Goodrich Industrial Tires and information on how they pay for themselves.

Name _____

Company _____

Street _____

City and State _____

Take off the INVISIBLE Brakes—

The unseen forces that:
—REDUCE POWER
—RETARD SPEED
—INCREASE COST
—CHEAT PRODUCTION
—WEAR OUT MACHINERY

DIXON'S GRAPHITED LUBRICANTS successfully fight friction, check machinery wear, increase power—which means *higher plant efficiency.*

DIXON'S TICONDEROGA
FLAKE LUBRICATING GRAPHITE

meets the exacting lubrication requirements of present-day fast-speed power and production equipment all over the world.

For fifty years power engineers have recognized the inherent qualities of this Dixon product—and they rate it higher today than ever before as an indispensable lubricant, an invaluable coating for gaskets, for packing and miscellaneous uses, with modern fast-production machinery.

Dixon's Ticonderoga Flake Lubricating Graphite comes in two Flake sizes:

No. 1—Large unctuous, lustrous flakes of highest grade.

No. 2—Finely, sub-divided, powdered flakes of highest grade.

DIXON'S MICROFYNE FLAKE GRAPHITE

Processed to a microscopic subdivision in particle size. Offers oilless, greaseless, temperature-proof, combustion-proof, water-proof lubrication. When used as a co-lubricant with oil or grease, it often gives more than double the service. Can be cleanly and economically applied with a Dixon's Rubber Graph-Air Gun.

Available in cans, buckets and drums.

Write Dept. C-44 for booklet: "Dixon's Graphite Productions For General Industrial Uses."

HANDLED BY ALL DEALERS

JOSEPH DIXON CRUCIBLE CO.

Jersey City, New Jersey

DIXON'S GRAPHITE PRODUCTIONS

SEND FOR CIRCULARS

7685

sense economy. But we had at one time 34 inter-departmental truckers, the fellows whose jobs were taken over by the electrics and who were transferred to other work.

The 34 hand-trucking jobs have been supplanted by nine men and six trucks, which should give a fair guide to the savings involved.

Good Inspectors Are More Than Rejectors

(*Continued from page 79*)

There is a great difference between an inspector trained in bar-stock machining and one who can check any machined casting or fabricated part. Good machining inspectors are, as a rule, hard to get, because not all good machinists make good inspectors. Speed and judgment are essential. The first operation on the first piece must be checked and passed before continuing with the succeeding operations. Wherever the activity justifies, tools should be provided not only for machining purposes, but also for inspection, to eliminate the human element as far as possible. Inspection gages and fixtures are time-savers and will allow operators to check their own work on occasion.

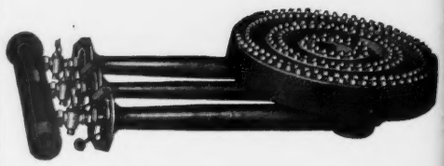
Doesn't Wait

The positive inspector does not always wait until a difficult machining operation has been completed, but assists in setting up the job or makes periodical checks while the job is still on the machine. Tolerances on drawing dimensions are based on assembly requirements and machining limitations. Tolerances should always be as liberal as possible, for a matter of a few thousandths sometimes means a great difference in the cost of the machining. The positive inspector analyzes the tolerances to be sure that they are adequate but not impractical. As it is impractical and unnecessary to inspect every operation on every part machined, he must use his judgment as to the part and number to be inspected. Where piece count is necessary for payroll purposes, a piece counter or negative inspector should be provided.

Substitution of positive for negative inspection in one machining department cut the cost of inspection 55 per cent, the cost of defective material 68 per cent.

Assembly operations usually depend entirely on the human element. The positive assembly inspector

JOHNSON NO. 60BCE
Triple Atmospheric Ring Burner



Johnson Triple Atmospheric Ring Burners are made up of three independent burners which may be used singly, in pairs or in triple. Efficiency, utility and economy are outstanding factors in the success of this powerful, durable unit. Each burner has two rows of raised gas port holes and is individually controlled. Johnson Venturi Mixing Tubes; A.G.A. Type Valves and Johnson Patented Direct Jet Regulators assure proper adjustment, perfect combustion and high flame temperature. Write for free catalog.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

CHARAVAY
FANS
THE OLDEST NAME IN PROPELLER-TYPE VENTILATION

for
- Plant Ventilation
- Man Cooling
- Materials Cooling
- Materials Drying
- Heat Dispersion
- Dust Control
- Fume Dispersion
- Air Circulation
- Home Ventilation
- Mine Ventilation
- Unit Heating

WRITE FOR FACTS!

HARTZELL
PROPELLER FAN CO.
ORIGINATORS OF
Propeller-Type Ventilation
WALNUT ROAD, PIQUA, OHIO
Sales-Engineering Offices Everywhere

Two Difficult Problems Solved by Two New Van Dorn Drills

THE new ¼-Inch Shorty Drill is designed for fast drilling in cramped, awkward quarters. Shorty can be used in practically any space you can reach your hand—and has the same power and speed of conventional straight-drive ¼-Inch Drills.

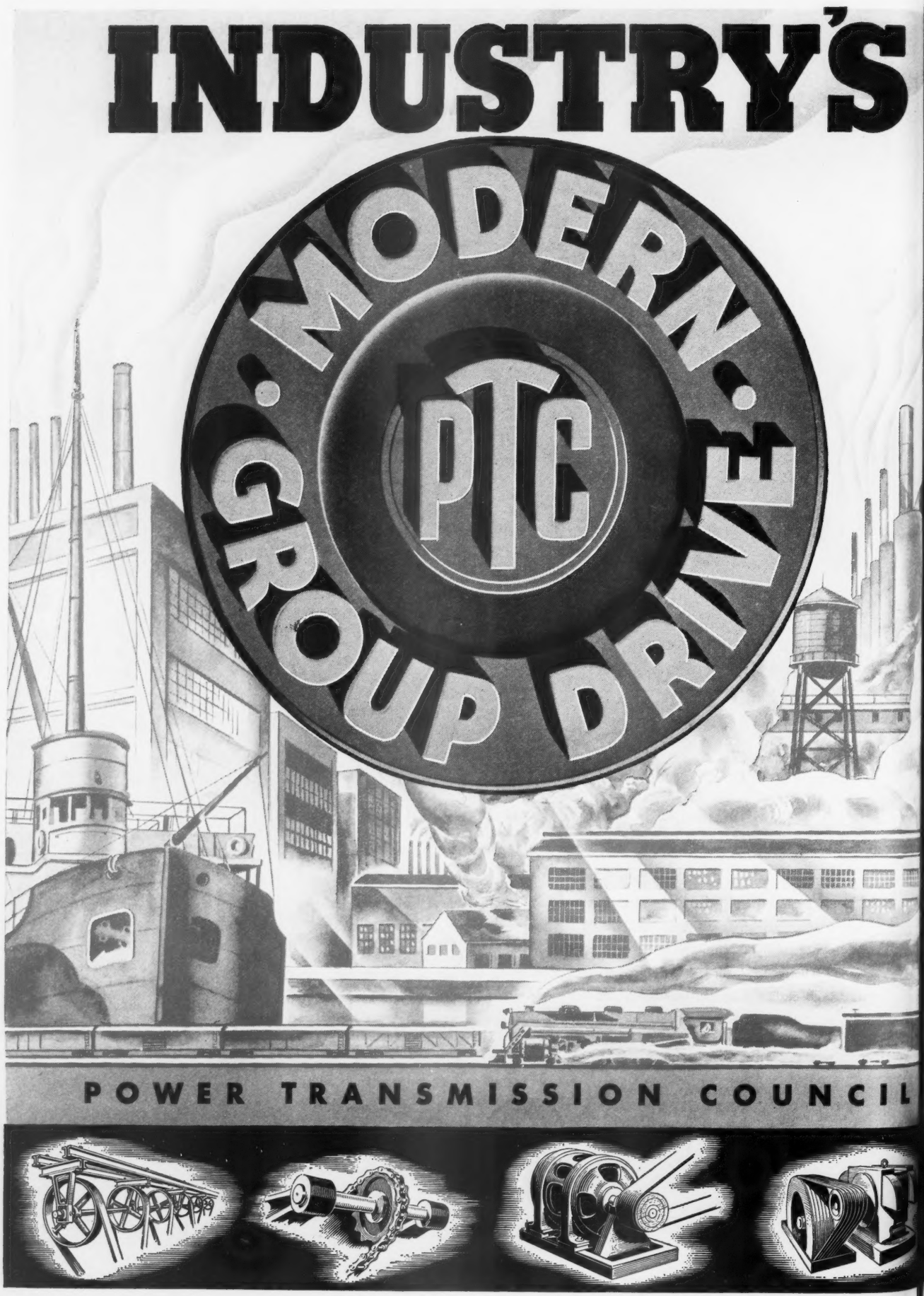
The new Low Speed ¼-Inch Drill (450 rpm) is for drilling in stainless, high carbon, case-hardened steel, monel metal, and other hard metals—reducing drill breakage and turning out cleaner, faster work. Ask your Van Dorn Jobber for a demonstration—or write for details. The Van Dorn Electric Tool Co., 719 Joppa Rd., Towson, Md. (Div. of Black & Decker Mfg. Co.)

FOR POWER, SPECIFY

"Van Dorn"

The Red-headed

PORTABLE ELECTRIC TOOLS


INDUSTRY'S
MODERN
PTC
GROUP DRIVE
POWER TRANSMISSION COUNCIL

New ALLY!

COMMITTED TO

Effective POWER Utilization

MODERN GROUP DRIVE PTC

FOUNDED on the accepted premise that no one type of drive can economically meet the varied operating conditions and production requirements of industry — the Power Transmission Council is aiding industry in the modernization of power transmission equipment and plant layout.

This program is justified by the fact that an extensive survey of American industrial plants shows that nearly a *billion dollars* worth of power is being wasted annually as a result of the use of inefficient and unsuitable power transmission methods.

In plant after plant—industry after industry — Power Transmission Council engineers and members of the Power Transmission Clubs in cooperation with plant, consulting and power engineers have in many instances saved as high as 38 per cent of power costs.

The Power Transmission Council is a national organization with a background of six years of valuable service to industry. It has no special cause to plead but is committed solely to a broad program of obtaining more effective power utilization in industrial plants of the nation.

Inquiries from manufacturers concerning power transmission problems are welcomed at Power Transmission Council headquarters. Consultation with experienced and qualified power transmission engineers involves neither charge nor obligation and cannot fail to suggest improvements which will result in power savings and increased production.

1. NATIONAL ORGANIZATION: The Power Transmission Council is the official spokesman for the Power Transmission industry. It is incorporated under the laws of the State of Delaware. It is committed to a broad program in behalf of more effective power utilization in industry.

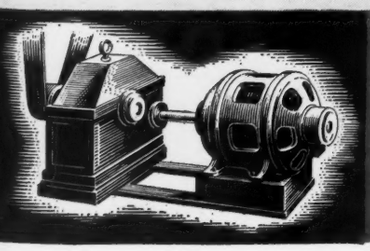
2. SOUND ENGINEERING: Only one laboratory is recognized by Power Transmission Council — the industrial plant. From studies made by competent and experienced engineers facts have been accumulated which guide recommendations and are available to industrial executives in the form of Case Studies.

3. REGIONAL ENGINEERS: A staff of competent power transmission engineers is maintained in leading industrial centers. They deal with facts — their recommendations are unprejudiced — their goal is more effective power utilization through planned power transmission.

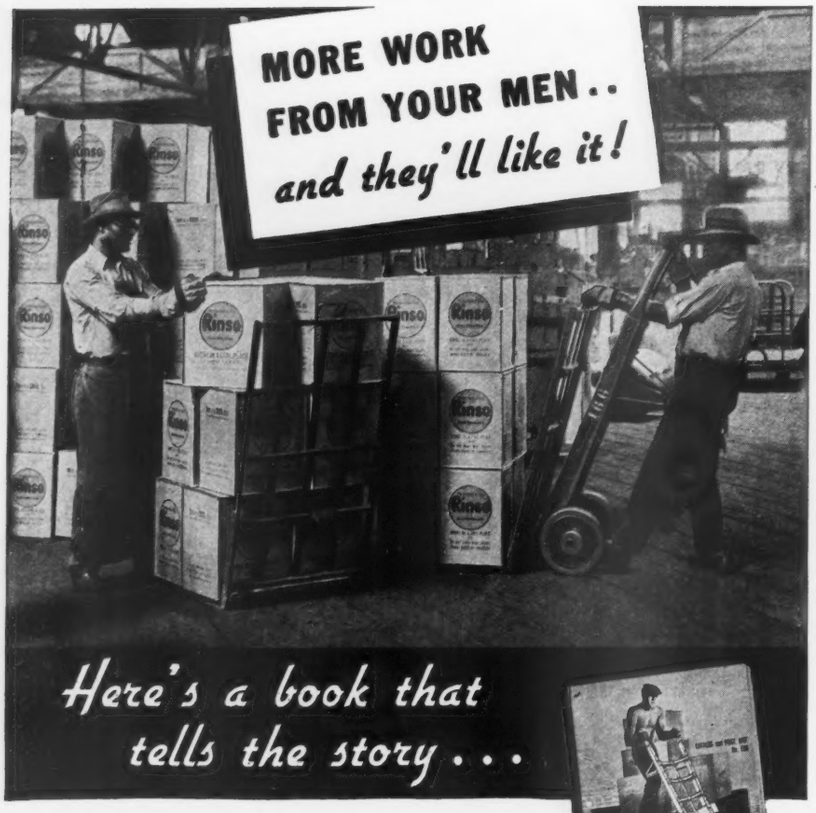
4. LOCAL ENGINEERING ORGANIZATIONS: 3,500 members of Power Transmission Clubs in industrial centers, affiliated with the national organization and working in cooperation with Regional Engineers are daily assisting industrial executives in the solution of their power transmission problems.

5. EFFECTIVE MERCHANDISING: The facts accumulated as a result of the Council Research program are used as a basis for a broad educational program and are widely distributed in the form of many valuable publications covering the many phases of industrial power transmission practice. Write headquarters for a complete list.

75 STATE STREET, BOSTON, MASSACHUSETTS



PLANNED *Power* TRANSMISSION

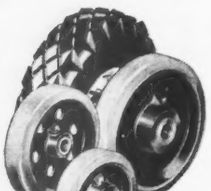


"American" Pressed Steel Hand Trucks roll along so smoothly—so quietly—*so easily*—that your men will get more work done without even knowing it. And you will find repair and replacement costs lower than you had believed possible.

The "American" Truk-Pak, pictured here, is a removable platform rack used with hand trucks to eliminate unnecessary rehandling. This equipment has many applications and provides unusual economies for warehouses, loading stations, transfers, etc. Ask your dealer or write direct to us for the American Pressed Steel Hand Truck Catalog illustrating trucks that answer all material handling problems.

American Tested Rubber-Tired Industrial Truck Wheels

Like American Hand Trucks, themselves, these wheels offer the rare combination of superior performance at lower cost. Savings on floors alone will pay for this quality equipment very quickly. Fragile material can be handled with less breakage and quiet operation is assured. A special vulcanizing process makes it impossible for these rubber treads to come off the wheels.



THE AMERICAN PULLEY COMPANY
4200 Wissahickon Ave.—Dept. 4—Phila., Pa.

AMERICAN
PRESSED STEEL
HAND TRUCKS

studies the personnel in his department, classifies in his mind the ability and habits of the individuals as they pertain to quality workmanship. This assists him in determining what and how much of the work done by each should be inspected. He pays particular attention to the parts and raw materials delivered to his assembly section. Inspectors know that by stressing the quality of seemingly small or insignificant parts or operations, the larger ones are taken care of automatically.

Proper assembly tools and clean assembly sections are part of the inspector's responsibility. Quality work can be done only with good tools under clean, orderly, and well-illuminated conditions.

Positive inspection has been of valuable assistance to the design engineer, not only because of the inspector's knowledge of manufacturing limitations, but also because he does not take all features of design for granted. Sometimes designs are such that the shop will find certain dimensions or adjustments difficult to maintain. In anticipation of trouble when the apparatus is placed in service, the positive inspector is, through his shop experience, in a position to insist on changes in design that will overcome these difficulties.

How 133 Plants Look at Wage Incentives

(Continued from page 77)

day. Hence it would be hard to pay many of them on one hourly rate set under measured daywork.

* * *

The adoption of measured daywork will eliminate some of the inequities under an incentive system in a plant such as ours doing a good deal of non-repetitive work. In our plant employees can only earn incentive when the work has been timed; their total earnings consist of their base pay plus incentive earned. Under the measured daywork system their total pay would be base pay plus an additional amount determined by their efficiency, regardless of whether they were working on timed work or not.

* * *

This puts the responsibility for eliminating daywork more squarely up to management, and to that extent is fairer to the worker. However, there is grave doubt in our minds as to whether it is possible to maintain a high rate of individ-

HIGH SPEED OR LOW . . .

LARGE ARC OR SMALL . . .

Multiple Trimmer Saw Unit equipped with Condor Endless Whipcord Belts. One of the most difficult saw mill drives because of exposure to weather and raising saws continuously. Saws being driven from one line shaft make constantly uniform belt length essential.

CONDOR ENDLESS WHIPCORD BELTS

Hug the Pulley . . .

AT every contact Condor Endless Whipcord Belts hug the pulley . . . grip the surface . . . transmit the full power-load for effective, economical, uniform production. . . . Designed for all types of drives, Condor Endless Whipcord Belts are particularly adapted for short or moderate length drives, with limited take-up, where high speed, high tension operation over small pulleys requires extreme flexibility, low stretch and high tensile strength.

To withstand rapid and continuous flexing, the load-carrying section of Condor Endless Whipcord Belts is made endless, placed on the neutral axis, and has practically no inelastic stretch. Of strong, treated whipcord wound continuously under balanced tension, the strength member is not spliced. Additional flexibility is gained by surrounding the strength member with an elastic, wear-resisting cover of strong duck, impregnated with rubber.

Condor Endless Whipcord Belts are specified for lower operating, maintenance and production costs by many prominent mills. On your next endless belt replacement order, get Condor Endless Whipcord Belts.

Condor PRODUCTS

Transmission Belt
V-Belt
Conveyor Belt
Air Hose
Contractors Hose
Sand Blast Hose
Suction Hose
Fire Hose
Hydraulic Hose
Steam Hose
Water Hose
Chute Lining
Launder Lining
Industrial Brake Blocks and Lining
Molded Rubber Goods
Rubber Lined Tanks
Rubber Covered Rolls
Abrasive Wheels Rubber Bonded

SIX ADVANTAGES

1. Low inelastic stretch.
2. Length not variable with atmospheric changes.
3. High degree of bending flexibility.
4. No ply separation.
5. No splice in tension or load-carrying section.
6. Unequalled longevity.

SOLD BY LEADING JOBBERS

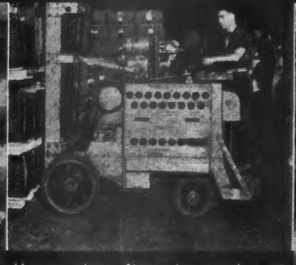
THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.

EXECUTIVE OFFICES AND FACTORIES, 33 TOWNSEND ST., PASSAIC, N. J.

UP TO 120 LBS. OF METAL PLATING PER

UNFAILING IN SERVICE WHERE PUNISHMENT IS HARDEST

Masterplate floor in service at the Wheeling Steel Co. plant, Steubenville, Ohio

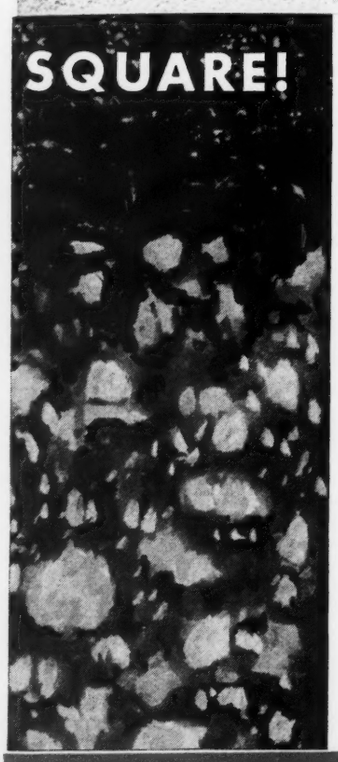


Masterplate floor in service at Follansbee Bros. Steel Mill, Follansbee, W. Va.

Masterplate floor in service at the shipping platform of the Welch Grape Juice Company plant, Westfield, N. Y.

Plate

The Wear-Proof, DEEP-PLATED metal armored Concrete Floor you've always wanted is here . . . *now!*



MASTERPLATE . . Master Builder's new super-concrete floor . . delivers *more wear per square foot* than any other type of concrete surface!

MASTERPLATE, the new metallic aggregate which produces The Master Plate Concrete Floor, contains a patented water-reducing agent which creates unbelievable plasticity. This makes possible the *quick, easy* installation . . . in low water-cement ratio floor topping . . . of up to 120 lbs. of MASTERPLATE metal armoring per square. *Less water* means greater density and durability! *Less water,* plus up to 120 lbs. of MASTERPLATE metal armoring per square, means 4 to 6 times *longer life!* MASTERPLATE installed by Master Builder's mechanized method produces the "last word" in Wearproof Concrete Floors.

Cut floor costs in *your* plant. Utilize MASTERPLATE with the Masterbuilt mechanized technique . . . plus Master Builder's experience gained in 26 years of service in the nation's largest flooring jobs. This efficient combination assures super-concrete floors that will deliver a *lifetime of wear!*

Free Folder

Send now for illustrated descriptive folder giving complete information on "MASTERPLATE—the new super-concrete floor."

THE MASTER BUILDERS COMPANY • Cleveland, Ohio
In Canada: The Master Builders Co., Limited, Toronto, Ontario

MASTER BUILDERS

24 HOUR SERVICE

ORDERS filled the day received—shipments back within 24 hours! That's the way brush orders are handled through the 74 warehouses of the Pittsburgh Plate Glass Company.

Why not take advantage of this convenient brush service? Why not concentrate your brush purchases in this one reliable source of supply?

There is a "Pittsburgh" warehouse near you—carrying a complete stock of Gold Stripe Brushes for all types of paint jobs—and a full line of Industrial Brushes—Floor Sweeps, Mill Dusters, Wire Scratch and Casting Brushes.

Refillable *Spiral Wound* Brushes of wire, horsehair and tampico can be furnished from the factory on special order for large scale production.

Write today for free illustrated catalog. State whether interested in brushes for maintenance or production, and what the production problem is. We will gladly place our engineering staff and service facilities at your disposal.

PITTSBURGH
PLATE GLASS COMPANY
BRUSH DIVISION · BALTIMORE, MD.

BRISTLE, WIRE AND TAMPICO BRUSHES FOR EVERY INDUSTRIAL NEED

ual efficiency under measured daywork even with the most competent supervision. For that reason we are not prepared at this time to consider the adoption of measured daywork. We prefer to attack the problem by increasing as rapidly as possible the percentage of our work on standard, plus perhaps the setting of temporary empirical rates on tasks which would otherwise be done on daywork.

* * *

We see an advantage in measured daywork in that the supervisor and foremen are required to assume greater responsibility and by having this responsibility they are more inclined to do actual preparation work, which will allow the product to come through at the anticipated cost. There is also the advantage of not being required to pay individual bonus rates which invariably leads to misunderstanding with the employee when conditions beyond their control affect their earnings.

* * *

More equitable than other systems.

* * *

Probable increase in production and lower labor costs per unit of output.

* * *

I believe piecework is preferable largely because it is simple and easily understood.

* * *

The comparison of actual vs. standard performance affords an expeditious measure of efficiency for the department and the individual. The worker knows in advance what his weekly earnings will be. This is based on the premise that rates will change dependent upon performance over a reasonable length of time. It also averages the good and bad days to which workers are subjected.

* * *

None over our system. Under the time study unit system the employee gets what he is worth. The efficient earn more than the deficient. Measured daywork tends to take away from the fast worker and give to the slow worker.

* * *

None.

* * *

Assured income to employee. Change in methods without disturbing rates.

* * *

Not practical in this company due to short runs.

* * *

The cost per piece is likely to be lower under measured daywork than under straight daywork since

IF YOU USE TRANSITE or SIMILAR COMPOSITIONS

SKILSAW WILL CUT THEM AT GREAT SAVINGS!

OVEN manufacturers and others who use Transite and other similar composition materials save time and money by using SKILSAW . . . because it cuts easier, cleaner, faster! In addition, it eliminates costly material handling because SKILSAW goes to the job—wherever it may be!

SKILSAW is the acknowledged leading portable electric handsaw because it has more power (model for model), is built stronger, will do more sawing jobs. Works from any light socket. Cuts wood, metal, stone and compositions.

MADE IN NINE POWERFUL SIZES

SKILSAW IS A TIME AND MONEY SAVER IN EVERY INDUSTRY . . . ON EVERY-DAY SAWING JOBS!

• Rips out 60 ft. of 3 in. old maple flooring in ten minutes! Cuts to pre-determined depth. Start work anywhere.

• Opens shipping cases quickly without damaging contents! SKILSAW saws through nails, resizes crating lumber.

• Cuts metal 10 times faster than a hacksaw! Cuts non-ferrous metals, lead, copper, lead-covered cables, steel and iron.

• Trims a door for hanging in 7 minutes! Cuts off strips no thicker than a plane-shaving. Ideal for partitions.

• Grooving is easy with SKILSAW! Makes smooth cut for weather stripping, tanks, vats, etc., up to 3¼ in. wide.

• Saves time in cutting car bracing! SKILSAW is ideal for cutting lumber used for blocking and bracing carload shipments.

See SKILSAW at Your Distributor's and Write for Our Complete Catalog

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214 East 40th Street, New York • 82 Brookline Avenue, Boston
1429 Spring Garden, Philadelphia
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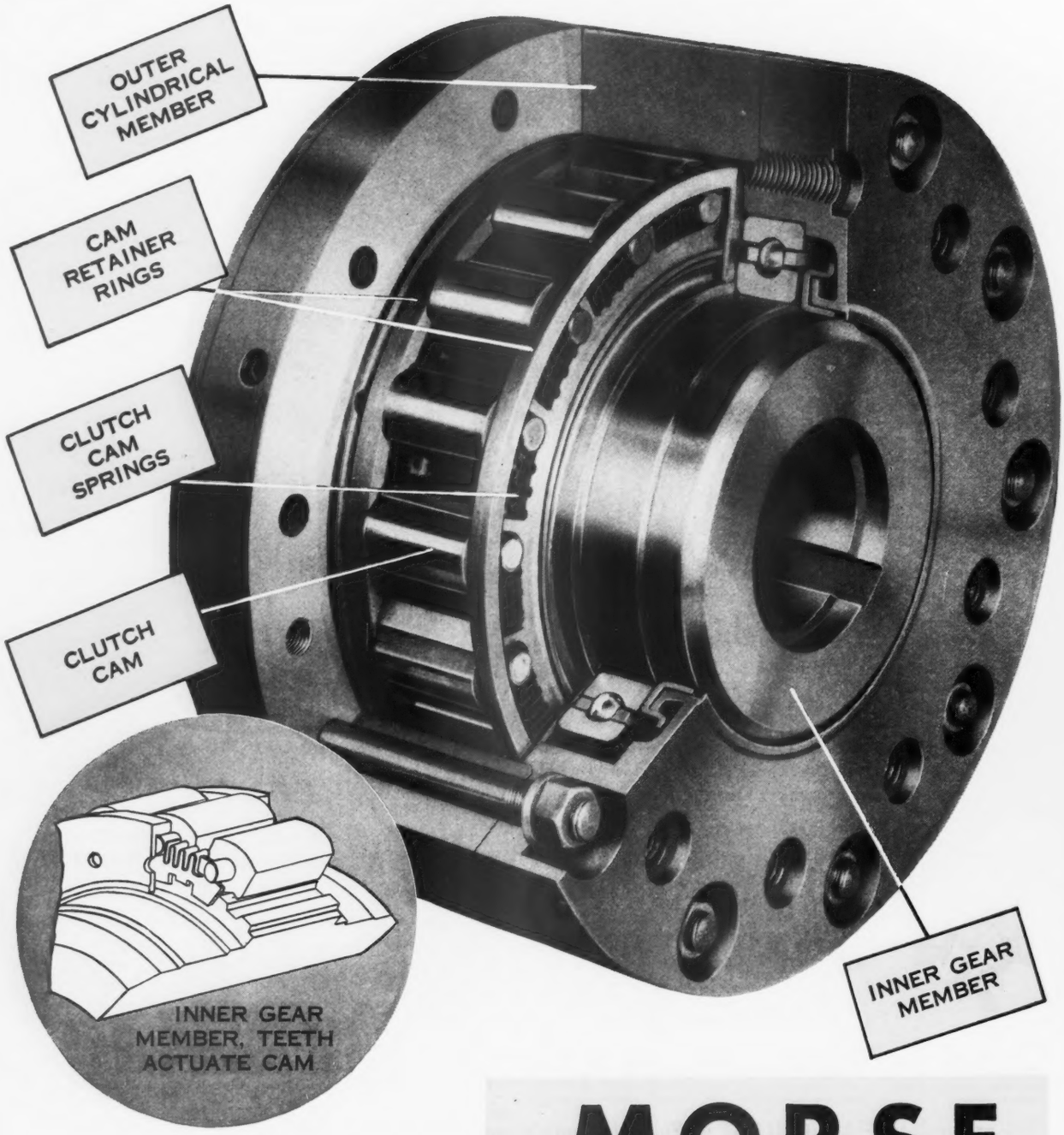
Kelpo FREE WHEELING CLUTCHES



MORSE

MORSE CHAIN COMPANY

FOR POWER PLANT Service!

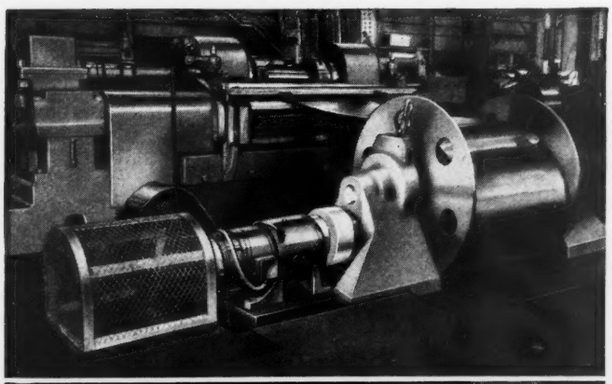
In many power applications, stand-by prime movers are frequently necessary. Morse positive free-wheeling clutches make this possible, greatly simplifying installation and improving the economy of operation.

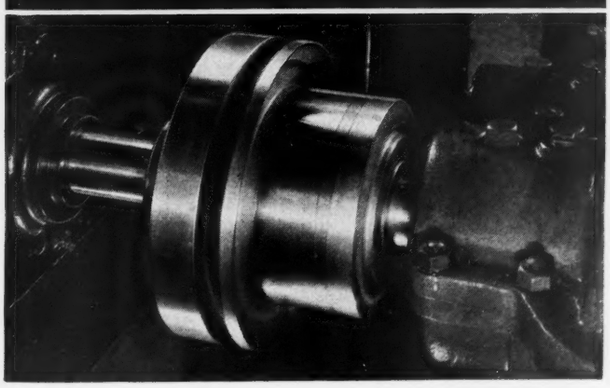
The frictional resistance of free-wheeling a Morse Kelpo is from 4% to 9% less than power loss in turning a dead prime mover. Power savings alone will pay for this clutch! It free wheels as easily as a ball bearing spins, yet it is as positive as a gear.

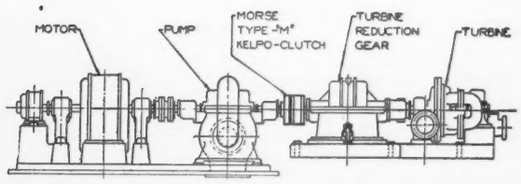
The engineering and construction of Morse Kelpo is such that it can free-wheel continuously month after month, or engage and disengage with as much regularity as is necessary in the job to be done.

High grade alloy steels are used in driving gears, cams and rings. Careful heat treating is utilized to prevent Brinelling of contact surfaces. Ball bearing members in each clutch separate driving gear and ring members, allowing the cams to float independently. Special cam retainers protect the cams from the effects of centrifugal force. Free wheeling resistance is at absolute minimum.

The services of Morse engineers are cheerfully offered in working out special applications. Call in your nearest Morse representative, or write direct to Morse, Ithaca.

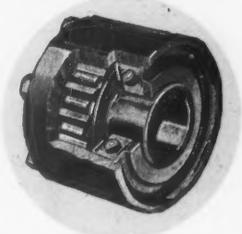






Above is a drawing of a typical installation of a Kelpo clutch on a dual power drive. Either power source may be operated independently of the other, with clutch free-wheeling and the idle driver at rest.

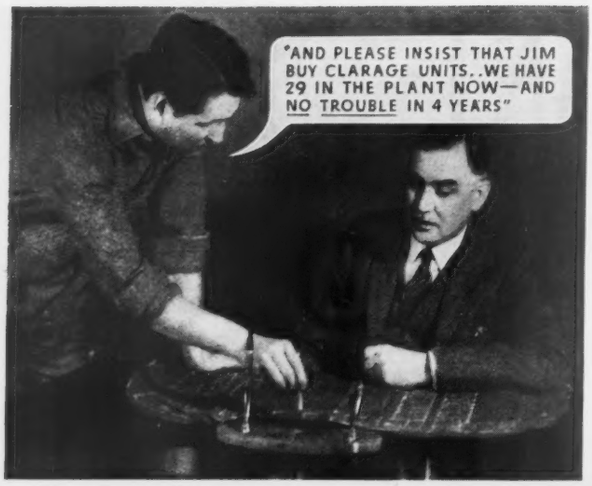
FREE WHEELING & INDEXING CLUTCHES



The Morse High Torque Indexing and Free Wheeling Clutch fills a definite need for an inexpensive, dependable clutch in many types of machine operations. It is particularly adapted to indexing and ratchet feed mechanisms in the machine tool field. It is sturdily built and positive in action. Grip and release are actuated by leaf springs in contact with the shouldered ends of the cams.

Positive DRIVES

ITHACA N.Y. DIVISION OF BORG WARNER CORP.



CLARCO HEATERS

These are the "little fellows" in the complete Clarage line, for heating small spaces, or where more heat is needed than present equipment can supply. Easily installed — suspended from the wall or ceiling. Suitable for pressures to 150 pounds. Fan and motor are quiet running. Large range of sizes.

REPEAT BUSINESS *Accounts for Over*
***72% of All* CLARAGE Unit Heater Sales**

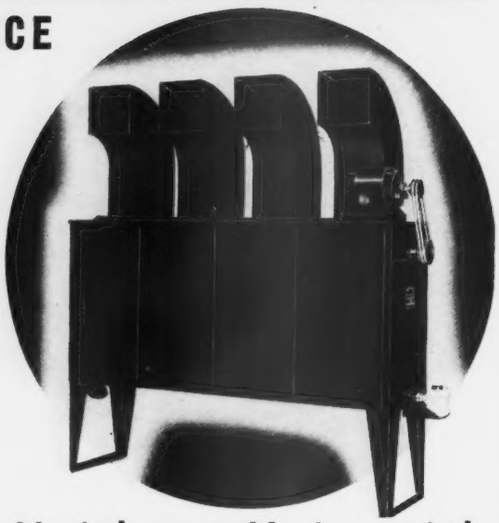
BETTER SERVICE the REASON WHY

From one automobile company we have received seventeen different orders for Clarage Unit Heaters — from another automobile company eight — from another six. One steel company reordered seven times — one paper mill five times — and so on.

The extent of our repeat business is the best recommendation we know of for these highly-efficient, trouble-free industrial heating units. Over the years shrewd buyers have come back to us time and time again.

They know from experience that Clarage Unitherm Unit Heaters are equal to the toughest heating jobs. They know that Clarage Heaters "stand the gaff" season after season, operating smoothly, quietly and without upkeep expense. (We balance every centrifugal fan wheel BOTH statically and dynamically; use larger shafts; provide a bent-tube safety coil construction.)

If you have any type of factory, office, warehouse or garage heating problem—large or small —you SAVE MOST by using Clarage equipment. Write today for complete information.



Unitherm Units with Syncrotherm Control Save Fuel Cost in Large Space Heating

IMPORTANT FEATURES: 1. Furnished for either floor or suspended installation, using steam or hot water. 2. Heating coil good for pressures up to 200 pounds. 3. Equipped with centrifugal fans, permitting use of outlet piping if desired. 4. Every part accessible by removing front or back section of casing. 5. Large range of sizes to meet every requirement.

SPECIFY CLARAGE for
COMPLETE AIR CONDITIONING
VENTILATION
HEATING
COOLING
MECHANICAL DRAFT
FANS & BLOWERS FOR INDUSTRIAL NEEDS

CLARAGE FAN COMPANY • Kalamazoo, Mich.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

waiting time, poor methods, slowness, etc., would probably have been eliminated in establishing of time standards for measured daywork.

* * *

We have it in certain departments. It is an excellent factor of control for production planning and standard costs. In many cases it serves as a first step to an incentive wage plan when processes are worked out and the time is right for incentive installation.

* * *

The only advantage that measured daywork appears to offer is the satisfaction that a fixed rate of pay for a limited period would offer the individual. This would be offset by the greater difficulty of adjustment by the individual worker to a lower rate after enjoying a fixed one at a higher level.

* * *

We believe we should expand our time and motion study program and after completion install a complete measured day rate plan. It gives the breaks to the worker when materials and machines, etc., are not kept up to standard conditions, which are for the most part uncontrollable from the workers' viewpoint. The plan also lends itself to building up interest of workers in cooperating with management.

* * *

I can see no advantage in measured daywork. Wage paid is based on past performance, and is not a direct incentive for increased effort.

* * *

None for industries in which operations are or can be reasonably well standardized.

* * *

We fail to see any advantages whatsoever in the measured daywork plan but many objections. One of the basic plans adhered to by wage incentive engineers in the past has been the immediate reward for the extra effort put forth in doing the job. If this reward can be given within a few days or a week it has always been felt that it is a much greater incentive than if it comes at the end of a 2, 3, or 6 months' period.

* * *

We have changed over all productive departments from individual bonus to measured daywork in the last year. Measured daywork is in general a more equitable form of incentive, but we are not convinced it would satisfy unions better than any of the other systems.

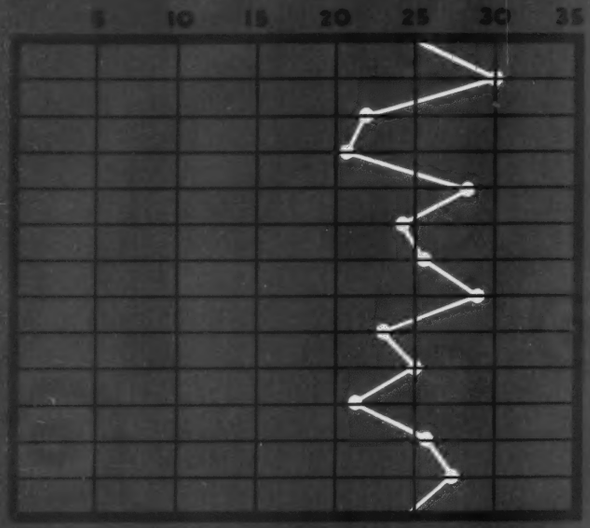
* * *

Measured daywork has no advantages over our system and has several disadvantages, the main one of

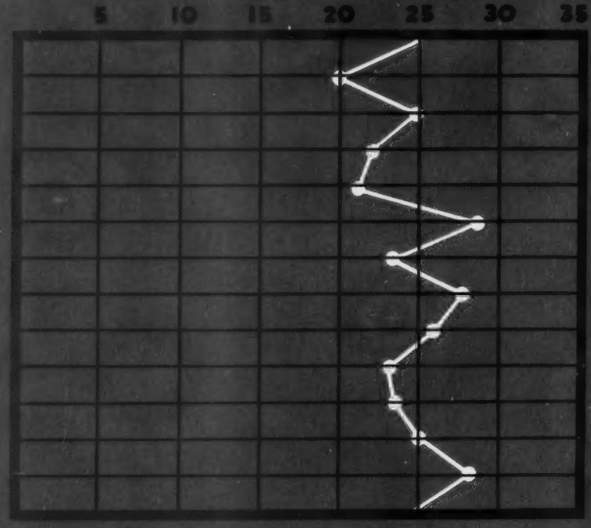
Nothing like this has ever been accomplished before. File teeth made on the principle of controlled serrations. Notice the irregular top edges of the tooth points. That's the secret of an outstanding file success.
"CONTROLLED SERRATIONS"
NEW TOOTH CONSTRUCTION
PRODUCES SENSATIONAL RESULTS
Wherever files are used, wherever faster removal of stock and lower file costs are important, the New Nicholson, Black Diamond and McCaffrey Files are producing results no other files have accomplished.
With their new tooth construction, these files remove far more metal. Priced the same as other files of the same general grade, they actually cost far less to use.
And every one of these files is made to a uniformly high standard. No variations to interfere with smooth production. Turn this page for brass tack demonstrations of the advantages of controlled serrations.
Nicholson File Company, Providence, R. I.
MADE IN THESE BRANDS
NICHOLSON
BLACK DIAMOND
McCAFFREY
A FILE FOR EVERY PURPOSE

WHAT ARE THE RESULTS W
ARE MATCHED AGAINST C

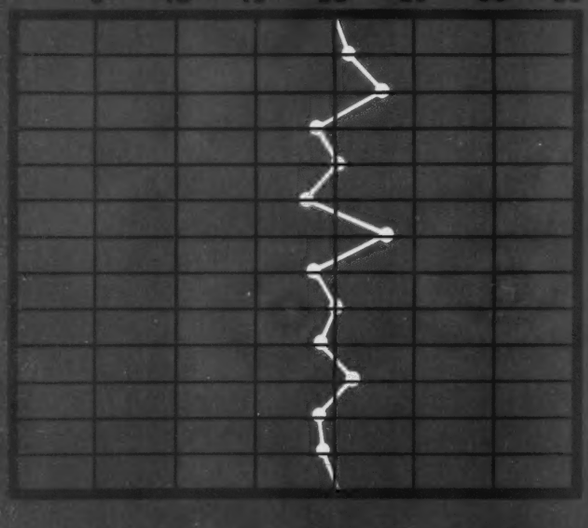
"A" ANOTHER BRAND



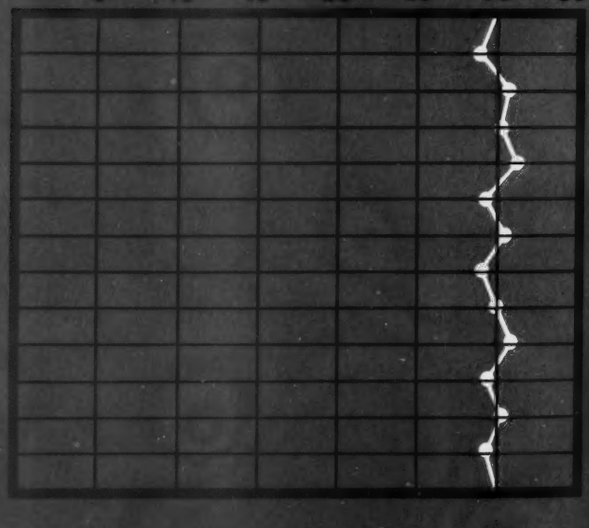
"B" ANOTHER BRAND



"C" ANOTHER BRAND



OUR NEW STYLE FILE



TEST CONDITIONS

All files are 12" Flat Files tested on high carbon steel. Brands covered to hide identities. Tests made by hand. Same number of strokes.

KEY TO CHARTS

Area to left of vertical line represents units of work. Vertical line represents absolutely uniform performance.

LE
A
AB
ST
FO
LO

Here
were
here'
over

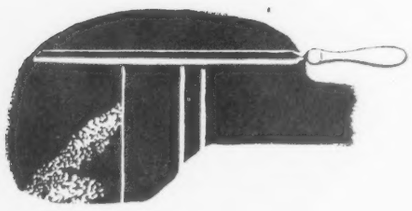
ABI
Our
again
other

C

WHEN OLD STYLE FILES CONTROLLED SERRATIONS

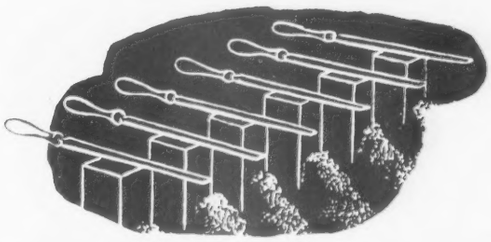
LET CHARTS TELL YOU A STORY OF GREATER ABILITY TO REMOVE STOCK . . . . MORE UNIFORM PERFORMANCE LOWER FILE COSTS

Here's what happened when our files were matched against other files—here's how controlled serrations won over other types of construction.



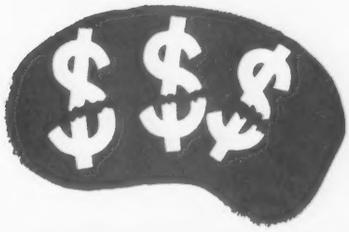
ABILITY TO REMOVE STOCK

Our files completed 30 units of work against 25.0, 23.6, and 20.5 units for other brands.



UNIFORM PERFORMANCE

Notice how the zig-zag line charting the performance of our files hugs the line of absolute uniformity; how lines charting other files break away from it.



LOWER FILE COSTS

"A" another brand, cost 20.1% more to use than our files

"B" another brand, cost 27.6% more to use than our files

"C" another brand, cost 46.9% more to use than our files

CONTROLLED SERRATIONS WIN

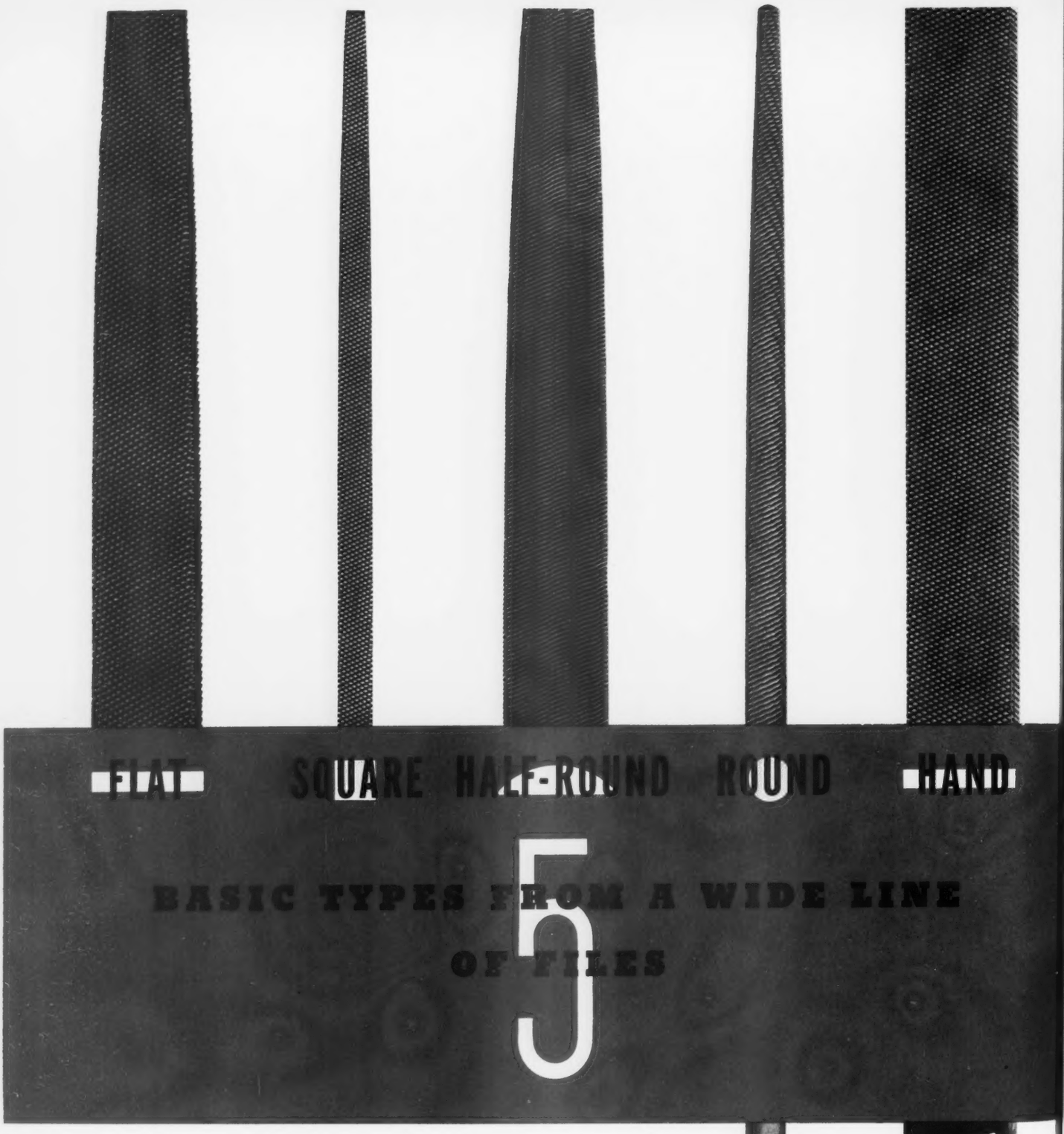
MADE IN THESE BRANDS

NICHOLSON

BLACK DIAMOND

McCAFFREY

PATENTS PENDING



Flat... Square... Half Round... Round and Hand... these five types of Nicholson, Black Diamond and McCaffrey Files are constantly used by mechanics in practically every industrial plant.

The five types illustrated are part of a great line of files — a line to which new tooth construction and high manufacturing standards bring outstanding efficiency.

Check your supply of files. See that your file equipment is well rounded. Your mill supply dealer or hardware wholesaler can meet your needs.

A FILE FOR EVERY PURPOSE

YOU DON'T have to be a wizard to produce instantly one or one million bronze bearings at any time—in any or all of hundreds of different sizes—completely machined and finished, ready for assembly—meeting practically every requirement in all kinds of machinery and electric motors. Simply select what you want from Bunting's Catalog of Standardized Bearings. Your order is filled the day we receive it... Economical, too—small lots even at big-run prices.

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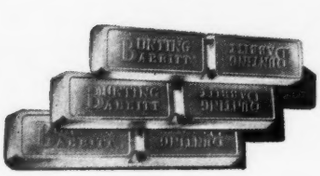

BUNTING Bunting **Quality**

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MACHINED AND CENTERED BRONZE BARS
BABBITT METALS

Here's the Rule for

PERMITE

Ready-Mixed **ALUMINUM PAINT**

Think of the money you can save on paint and labor costs by using Permite Ready-Mixed Aluminum Paint! Because of its better "leafing" and better hiding qualities, ONE COAT instead of two is the rule. The Permite finish lasts longer, too. Gives extra protection against heat, cold, moisture, steam, fumes, acids and other corrosive agents.

THERE'S A TYPE FOR EVERY NEED

No. 1000–Interior; No. 5000–Exterior; No. 2000–Equipment; No. 7000–General Purpose Maintenance; No. 1100–Heat-Resisting; No. 1200–Lacquer; No. 3000–Baking; No. 6000–Dipping; No. 8000–Federal Specification.

Write for new Permite Ready-Mixed Aluminum Paint Booklet explaining how you can reduce painting costs.

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Permite Distributors in Principal Cities

which would be the difficulty in employees being able to figure what their earnings should be. Our incentive wage is so simple that probably 95 per cent of our employees know what their earnings are before they ever get paid for them.

* * *

Interprets incentive earnings directly into a rate per hour. We prefer our method of a lump sum bonus payment once a month.

* * *

None. Disputes concerning higher wage levels, set-up, daywork standards, merit, seniority, and the right to lay off subnormal workers or the right to lay off in subnormal times will not have been eliminated or simplified.

* * *

Cannot see any advantage. Believe the incentive system most practical. On measured daywork the union resents the taking of time studies and the setting of standards on operations on which they work.

* * *

Except for a saving in clerical labor it appears to have but few advantages from a management standpoint, and would require more supervision to maintain production unless the rates were subject to periodical revision on the basis of past performance. Use of such periodical revisions can be considered merely a modification of an incentive system.

* * *

We feel the periodical fluctuation of earning rate is difficult to administer and is disturbing to favorable psychology of workers relative to guaranteed base rate with bonus for extra effort.

* * *

There is an advantage in the temporary stabilization of employees' pay. It is questionable, however, if more satisfactory in the long run.

* * *

Measured daywork tags a workman with a certain standard which as a matter of pride he will try to live up to. It avoids fluctuations in earnings, always a sore point. It imposes more responsibility upon management.

* * *

Closer measurement of each individual and no excuses for not measuring up to standard set. This leaves no room for extra wages on surplus performance, however.

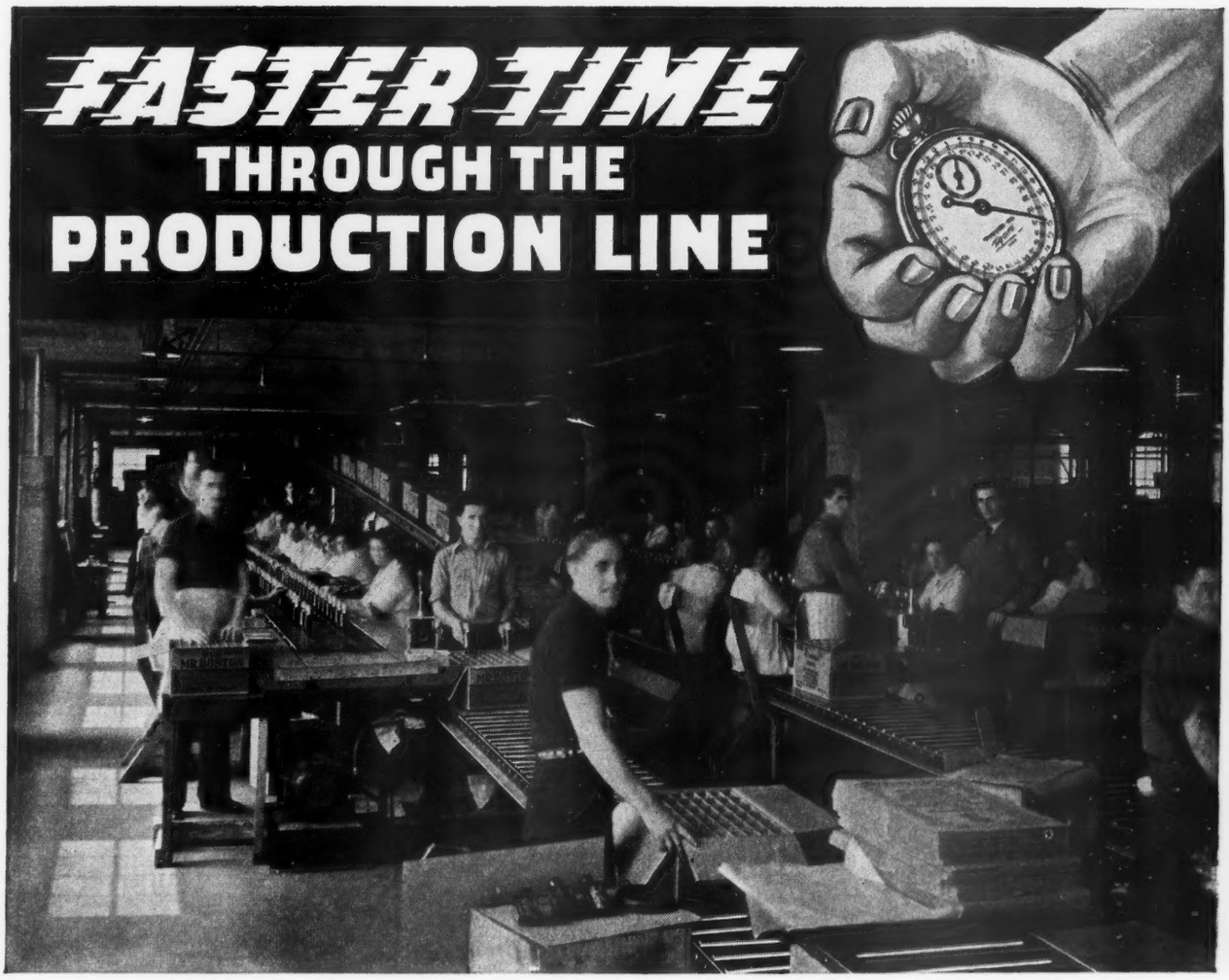
* * *

No variation in weekly pay.

* * *

In our opinion measured daywork entails the irritation of an in-

FASTER TIME THROUGH THE PRODUCTION LINE



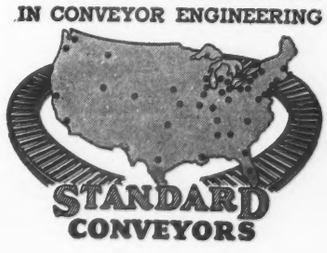
"Conveyors by Standard" FM-10—a valuable reference book on conveyors and conveying methods. Sent free to plant and production executives.

Planned handling through conveyor engineering and installation makes for faster time through the production line . . . speedier, less costly handling of goods in warehouse and shipping department.

Plan your material handling to speed production and lower costs . . . give your conveying methods a thorough check-up, make needed replacements, change over to faster, better handling with Standard Conveyors.

Standard Engineers . . . specialists in conveyor engineering, with an experience record of over thirty years . . . will assist you in improving your present material handling methods and equipment. There is a Standard office near you —communicate with them.

A NATION-WIDE SERVICE IN CONVEYOR ENGINEERING



STANDARD CONVEYOR COMPANY

GENERAL OFFICES: NORTH ST. PAUL, MINN.

Simplex

Push and Pull

Jack

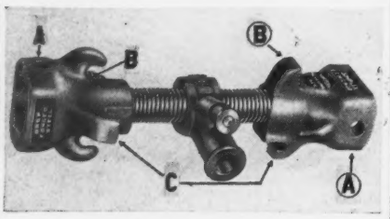
And Equipment

What it does:

It serves as a time and money saver on countless maintenance, repair and production jobs involving:

1—Pushing
2—Pulling
3—Spreading
4—Clamping
5—Lifting
6—Pulling Wheels

How it is used:



1 Insert any length of standard 1½" pipe in either or both well ends for PUSHING. Powerful—10 tons capacity. Ideal for close-quarter operations. Useful for hundreds of purposes.

2 Insert Sky Hooks at A and Ⓐ —attach chains to Sky Hooks—jack used this way for CENTERED PULLING. Handy, quick, powerful. Many needs for it every day—a good way to economize.

3 SPREADING. The minimum is 3½". Plenty of power—does the work quickly. Saves costs every step of the way. SPREADING can also be done on the ends of the nuts. Note B and Ⓑ

4 CLAMPING. For clamping structural members or tensioning struts when welding broken pieces. Ideal for repair work on conveyors, elevators, chutes, rails, etc. Please refer to C.

5 LIFTING. Attach the snap-on base at A or Ⓐ . The broad base gives you a Lifting Jack of unusual capacity and adaptability.

6 All types of Wheels and Gears are easily PULLED by fixing the chains in the 3 nests of the 3-Way Base which has been snapped on at Ⓐ . The hardened conical point is centered in the shaft after the nut in that end has been removed.

What it consists of:

1. No. 610 Simplex Special Push and Pull Jack.
2. Sky Hooks (2), drop forged steel, heat treated.
3. Three-Way Base (and wheel puller attachment) drop forged steel, heat treated.
4. No. 3-A Simplex Spreader Jack.
5. ½ inch x 40 inches Heat Treated Chains (3), fitted with drop forged grab hooks.
6. Drop forged, chisel pointed Lever Bar, heat treated ¾-inch round x 18 inches long.
7. Three Simplex Stud Links, drop forged steel, heat treated.
8. Steel Tool Box, 19x7x7¼".

Stocked by Leading Supply Houses

Templeton, Kenly & Co.

World's largest mfrs. of Lever & Screw Jacks for Industrial Use.

1020 So. Central Ave., Chicago

centive system without its redeeming good points.

* * *

No advantages over a guaranteed dayrate with incentive provision.

* * *

Probably more opportunity to recognize and reward individual merit.

* * *

Easy to understand and operate, although I am not in favor of it except where employment is steady.

* * *

It is dangerous to drop an established plan to which the organization has become accustomed, and which produces results.

* * *

Tends to reward the best workman and to give the average man a fair wage.

* * *

No advantage over straight piecework but disadvantage in high labor turnover.

* * *

I see no advantages except for group work.

* * *

None at all over proper bonus—and many disadvantages. Measured daywork is nothing more than a bonus, inaccurately set, and payable too long after performance.

* * *

Too complicated. No advantage that we can see.

* * *

Do not think any advantage over good incentive plan.

* * *

Measured daywork, although providing apparent greater security to the employee fails to compensate him for individual effort greater than that usually asked.

* * *

More uniform pay from week to week.

* * *

No advantages. We believe our present establishment of base wages by job analysis and our system of supplementary wage incentive plans are much superior.

* * *

Lower production cost per unit provided every employee does a measured day's work or better, and supervisory costs are not excessive.

* * *

Simplification of payment of incentives—more uniform weekly earnings—however, do not believe production will be as greatly increased under measured daywork as under present incentive plan.

* * *

I think that under measured daywork a premium should be paid if

100 Standard Models of Industrial Counters

Durant *Productimeters* for 58 years have recorded the output in all fields of industry. Counters and registering instruments for almost any industrial use can be supplied from stock. We are also constantly designing counters to meet new or special problems. Let a Durant engineer consult with you on the best means of equipping your plant with counting machines.

Productimeters
THE SPEEDOMETERS OF INDUSTRY

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TELL US WHAT YOU WANT TO COUNT

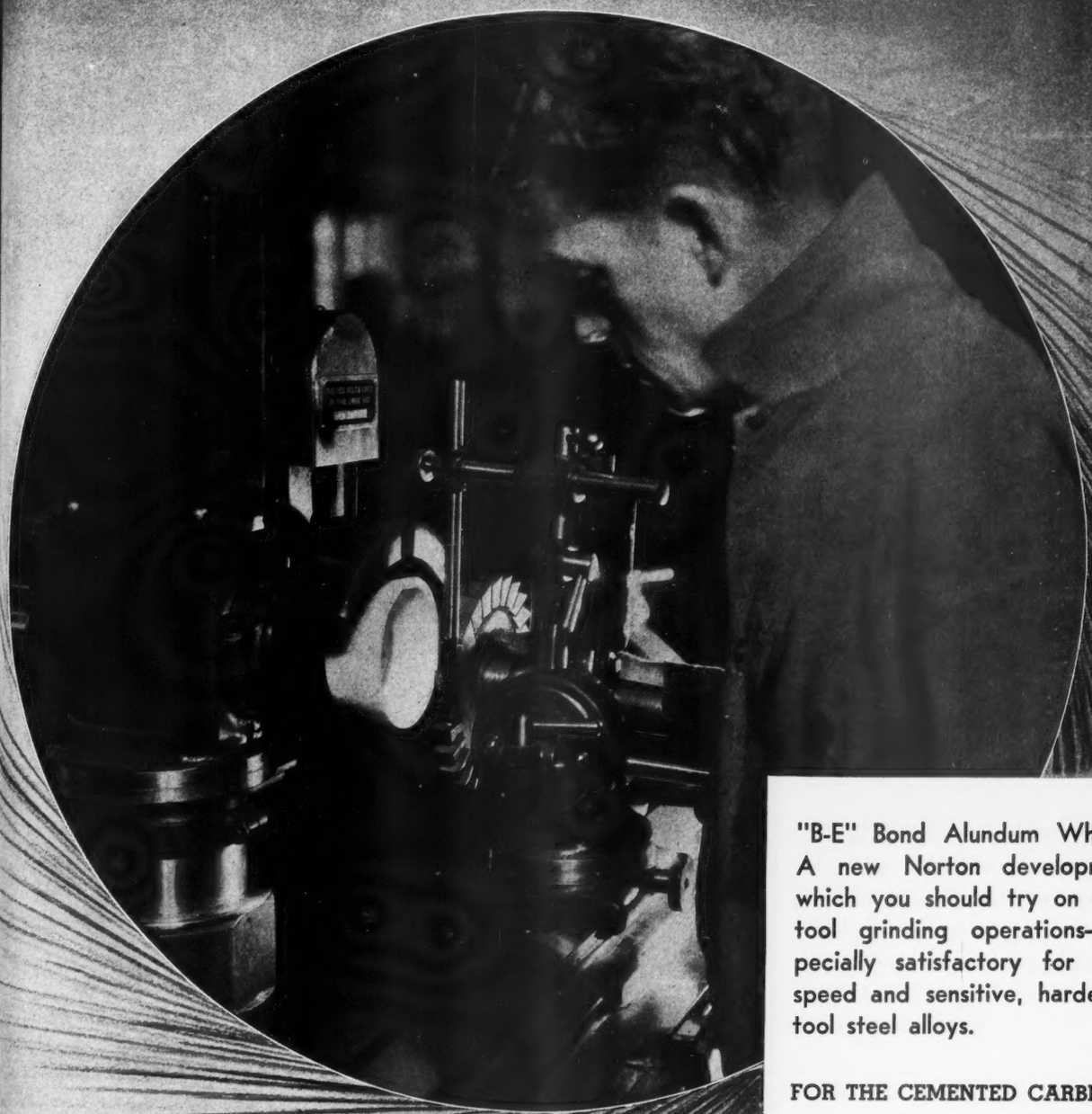
Precision-and
ENDURANCE

CHICAGO RAWHIDE Packings end power losses—seal perfectly, completely—for they are uniformly exact in size and shape, are precision made.

They give long uninterrupted service, prevent break downs and minimize shut downs for they are formed from Mechanical Leather—special hides, mechanically tanned and treated to closely held factors of hardness, resiliency, heat resistance and flexibility. For all around performance and absolute dependability specify "Chicago Rawhide" in packings.

CHICAGO RAWHIDE MFG. CO.
1293 ELSTON AVENUE, CHICAGO, ILLINOIS

TOOL GRINDING



"B-E" Bond Alundum Wheels. A new Norton development which you should try on your tool grinding operations—especially satisfactory for high speed and sensitive, hardened tool steel alloys.

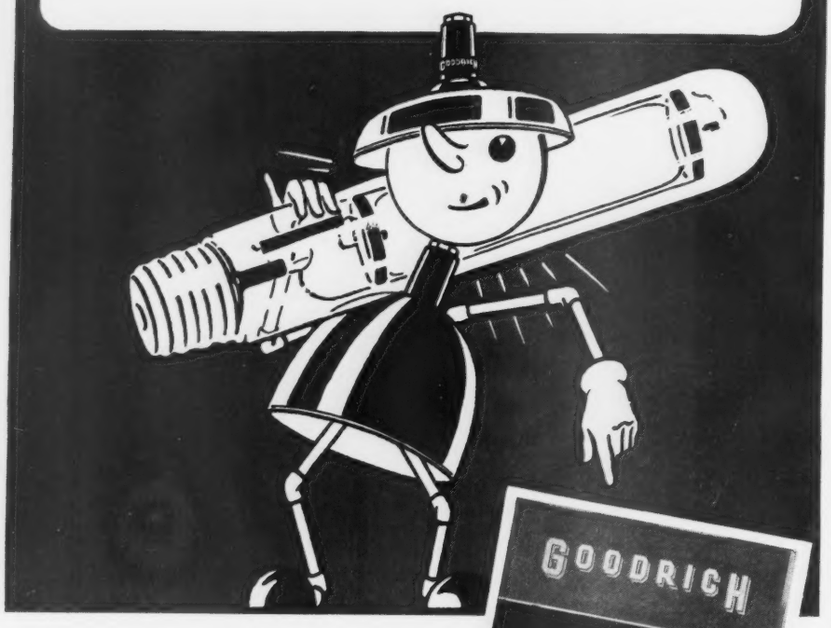
FOR THE CEMENTED CARBIDES

Norton Diamond Wheels
Green Crystolon Wheels

NORTON COMPANY

NORTON ABRASIVES

"For Mercury Vapor Lighting..."



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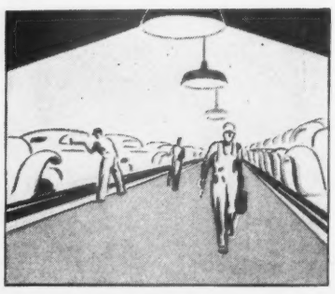
● Again, Goodrich has led the way—this time in designing new fixtures to meet a wide variety of applications with mercury vapor lamps.

Whether it's steel or textiles . . . machine shop, laboratory or inspection department . . . whether it's solely for higher intensity or color correction with combination mercury and incandescent lamps, there's a Goodrich fixture of the right design to meet your requirements.

The new Goodrich Catalog of Mercury Vapor Lighting Equipment is just off the press. It's complete with engineering data, light distribution curves, etc. Your copy is waiting for you.

With almost daylight brilliance, mercury vapor lighting has proved its efficiency in thousands of industrial plants. You insure best results when you use mercury vapor lamps with Goodrich Reflectors.



WRITE FOR YOUR COPY—ASK FOR CATALOG NO. 81

GOODRICH ELECTRIC COMPANY

OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 2904 N. OAKLEY AVENUE, CHICAGO, ILL.

work is produced in less than the standard time. Cannot see much advantage in it compared with bonus systems.

* * *

None—would keep one eternally after those who fall behind.

Is Present System Understood?

And the final question also brought a great many replies. However, so many said the same thing that they can be summarized briefly.

The question: What assurance have you that your operators understand your present incentive systems and have complete confidence in them? Summary of the answers:

Results of survey of individuals.

In operation a long time without complaint.

Employees are able to compute their earnings.

Employees kick if we are slow to set standards for new operations.

Freedom from wage disputes and complaints.

Employees recommend improvement but not abandonment.

Employees on day rates asking for incentives.

Some replies say frankly that they have no assurance. Others say complete confidence does not exist. The majority, however, feel that employee feeling is good. There is a pronounced indication that management recognizes the importance of the question and is working hard to gain and merit both understanding and confidence on the part of employees.

•

TRADE LITERATURE

Air Conditioning—Booklet, on industrial air conditioning, refrigeration, and space heating.—Carrier Corp., Newark, N. J.

Bearings—Catalog No. F-958, describing complete line of ball, roller, and thrust bearings. — Norma-Hoffman Bearings Corp., Stamford, Conn.

Building Maintenance Supplies—Catalog, on line of floor finishes, cleaners, soaps, deodorants, disinfectants, etc.—Vestal Chemical Laboratories, Inc., Dept. FMM-7, 4963 Manchester Ave., St. Louis, Mo.

Clutches—Catalog No. 1532, on friction clutches.—Link-Belt Co., 307 North Michigan Ave., Chicago.

Coupling — Folder, describing Celoron molded plastic coupling. — Continental-Diamond Fibre Co., Newark, Del.

Cranes—Folder, showing cranes and transfer bridges.—The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

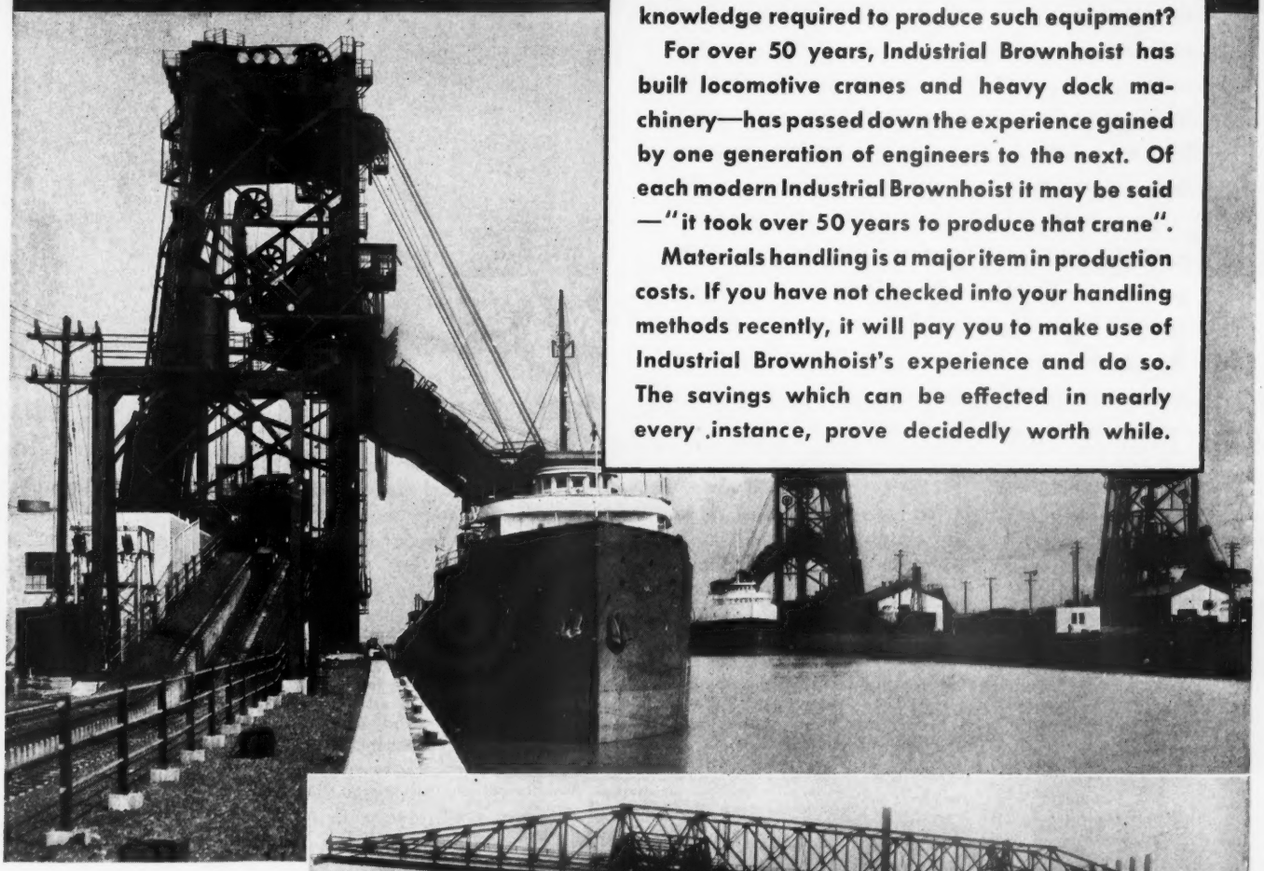
Diesel Generating Sets—Bulletin 3600-A2,

Loading 120 tons of coal per minute Handling 15 tons of ore per grab

While watching modern dock machinery handle huge tonnages of coal, ore or stone, have you ever stopped to consider the vast amount of technical knowledge required to produce such equipment?

For over 50 years, Industrial Brownhoist has built locomotive cranes and heavy dock machinery—has passed down the experience gained by one generation of engineers to the next. Of each modern Industrial Brownhoist it may be said —"it took over 50 years to produce that crane".

Materials handling is a major item in production costs. If you have not checked into your handling methods recently, it will pay you to make use of Industrial Brownhoist's experience and do so. The savings which can be effected in nearly every instance, prove decidedly worth while.



Each of the three Industrial Brownhoist car dumpers shown above will dump 120 tons of coal per minute. The bridge crane, at the right, has a bucket capacity of 15 tons of ore.

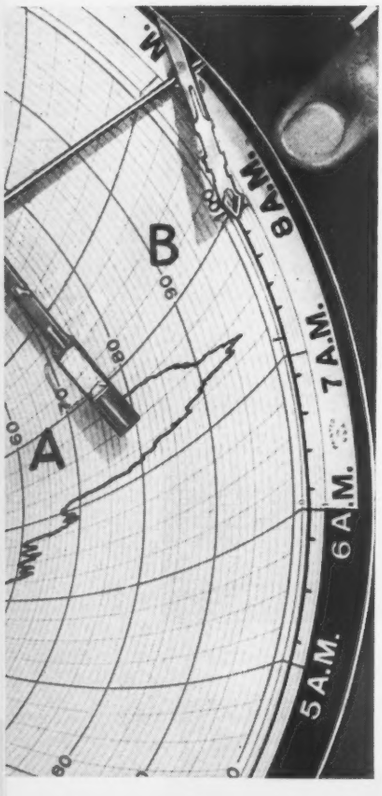
LOCOMOTIVE CRANES, 10 TO 200 TONS CAPACITY
CRAWLER CRANES, 6 TO 25 TONS CAPACITY
ERECTION CRANES, 10 TO 75 TONS CAPACITY
ORE AND COAL HANDLING BRIDGES
CAR DUMPERS FOR COAL AND ORE
CLAMSHELL BUCKETS

INDUSTRIAL BROWNHOIST CORPORATION
General Offices: Bay City, Michigan
District Offices: NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO

INDUSTRIAL BROWNHOIST

Seeing is believing

Hidden steam leaks may be running into thousands of dollars in your plant unless the steam you use in each department is separately recorded.



THE dual record on every Brown Flow Meter chart makes it impossible for this important loss to escape detection. Steam waste is detected and recorded automatically. With Brown Flow Meters measuring and controlling the flow of steam for Power, Heating or Processing you are completely protected because:

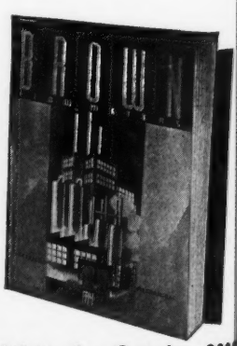
THE BROWN AUTOMATIC RECORDING PLANIMETER PEN "B": Making the marginal record shown on the chart at left, supplies proof that a definite number of lbs. of steam, or gallons of water, cubic feet of gas, or barrels of oil, were delivered, utilized—or wasted.

This is a special, patented feature of the greatest value to flow meter users. Reference to the automatic planimeter pen record on chart rim assists you to distribute departmental or process loads more uniformly over the working day, effecting substantial fuel savings not only in the boiler room but in every department or unit where steam is used.

THE RECORD LINE "A": shows the rate and records the total amount of steam generated by the boiler. It guides the fireman in maintaining the most efficient boiler operation to meet steam demand.

Another exclusive feature of the Brown Flow Meter is the flexibility of six interchangeable range tubes which permits changing the capacity of the flow meters to meet any flow requirement for differential pressures from 20 inches to 200 inches of water without disturbing the orifice plate or shutting down the line.

Brown Flow Meters give the ultimate in flow meter service; both electrical and mechanical flow meter bodies are designed for working pressures up to 2500 lbs.—they are easy to install and clean; parts are simple and few. Learn more about Brown Flow Meters—how they are different—why they are better—what they can do for you. Our engineers will be glad to discuss with you how Brown Indicating, Recording and Controlling Flow Meters can bring to manufacturing processes many of the economies they have effected in power production. Catalog No. 2005 fully describes Brown Electric and Mechanical Flow Meters and Air-o-Line Flow Controllers. Write for your copy. THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4461 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Toronto, Canada; 117 Peter Street—Amsterdam-C, Holland; Wijdesteeg 4—London, England: 70 St. Thomas' Street, S.E.1.



Write for Catalog 2005

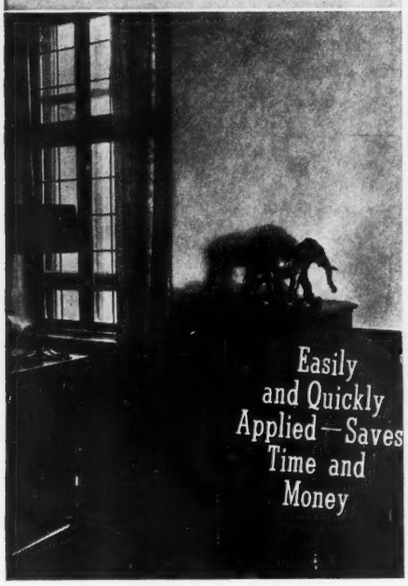
BROWN FLOW METERS *and* MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS

To Measure and Control is to Economize

The Low-Cost Way to Modernize Office Interiors—

TEXTONE

FOR TEXTURING WALLS



Combine with TEXOLITE for Pleasing Interiors of Enduring Beauty

1. Painter mixes Textone with water *as needed.*

2. He applies Textone with regular wall brush.

3. Unique textures are easily created.

4. One coat Texolite gives colorful finish.

■ Here is a new, low-cost method of texturing that provides attractive, durable walls in keeping with the vogue for colorful textures—*and does it more simply, in less time.* As shown, the painter mixes Textone* with water, applies a single coat, and textures as desired. He then applies one coat of Texolite*, the New Principle Paint, in your choice of color. Thus you obtain modern, colorful walls of lasting beauty.

Textone is the time-tested, proved texturing material used for years by leading decorators for both new and old work. It is adaptable to almost any surface; lends itself to any treatment. For Color Guide showing theory of color and illustrating color harmonies, mail coupon at right.

FOR YOUR PROTECTION, USG PRODUCTS BEAR THIS TRADE-MARK IDENTIFICATION ➡ UgS

*Registered Trade-marks

UNITED STATES GYPSUM COMPANY

Dust Collector—Bulletin No. 276, describing Type W Roto-Clone dust precipitator.—American Air Filter Co., Inc., First and Central Ave., Louisville, Ky.

Fire Protection—Booklet, on built-in carbon dioxide fire protection system.—Walter Kidde & Co., 140 Cedar St., New York.

Flexible Coupling—Bulletin No. 179, on Rybeck flexible coupling.—The T. L. Smith Co., 2835 North 32d St., Milwaukee.

Fuse Cutouts—Bulletin GEA-732F, on oil fuse cutouts.—General Electric Co., Schenectady, N. Y.

Generators—Two bulletins: No. 247 on a.c. generators, No. 249 on d.c. generators.—Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

Hard Facing—Booklet, title "Hard Facing with Haynes Stellite Products."—Haynes Stellite Co., Kokomo, Ind.

Heating System—Catalog M637, on Tallmadge Equatherm and Airotherm types of zone-controlled heating system.—Webster Tallmadge & Co., Inc., East Orange, N. J.

Insulating Materials—Revised edition of booklet "Barriers to Industrial Waste."—Johns-Manville, 22 East 40th St., New York.

Lacquer—Two bulletins: one on tarnish-proof lacquer No. 4527 for high mar resistance on brass and silver, one on clear lacquer No. 4917, a brass lacquer for outdoor exposure.—Roxalin Flexible Lacquer Co., Inc., Elizabeth, N. J.

Lamps—Price List of Birdseye reflector lamps.—Birdseye Electric Co., Inc., 100 East 42d St., New York.

Locomotive Cranes—Bulletin 371, on diesel and gasoline locomotive cranes. Industrial Brownhoist Corp., Bay City, Mich.

Magnet Brake—Bulletin GEA-2443A, describing three-shoe d.c. magnet brake.—General Electric Co., Schenectady, N. Y.

Magnet Controller—Folder, showing automatic-discharge type magnet controller.—The Electric Controller & Mfg. Co., Cleveland.

Maintenance Equipment—Catalog No. 21, on electical and mechanical maintenance equipment.—The Martindale Electric Co., Box 617, Edgewater Branch, Cleveland.

Metal—Bulletin No. 314, on Meehanite metal for engine casting.—The Cooper-Bessemer Corp., Grove City, Pa.

Meters—Bulletin 40-B12, on rotary displacement meters.—Roots-Connersville Corp., Connersville, Ind.

Mortar—Bulletin No. 450, describing Mortite shrinkproof, waterproof mortar.—The Truscon Laboratories, Detroit.

Paterson, N. J.—Booklet, title "Industrial Advantages of a Paterson Location."—The Industrial Commission, Paterson, N. J.

Pipe and Fittings—Bulletin A-1, on pipe, fittings, valves, fume duct.—Haveg Corp., Newark, Del.

Power Transmission—Bulletin, showing diesel-electric motive power transmissions.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Piping—Booklet, on welded piping.—The Linde Air Products Co., 30 East 42d St., New York.

Pipe Repairs—Booklet, listing clamps and other tools for making pipe repairs.—M. B. Skinner Co., South Bend, Ind.

Power Transmission—Dossier A-3, on power transmission for hammer mills.—Baldwin-Duckworth Chain Corp., Springfield, Mass.

Potentiometer—Broadside, announcing the Pyromaster, a round-chart recording potentiometer.—The Bristol Co., Waterbury, Conn.

Process Control—Bulletin No. 175-1, describing Stabilog process control, a system for automatic control of temperature, pressure, level, and flow.—The Foxboro Co., Foxboro, Mass.

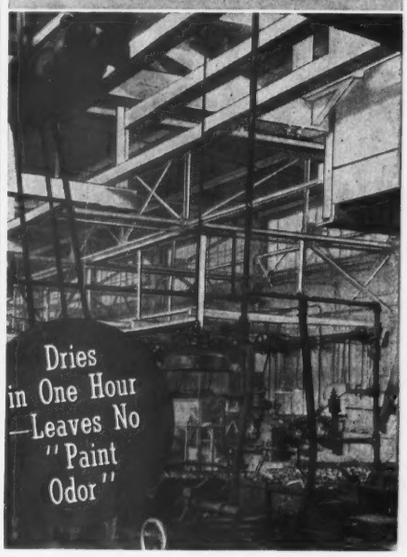
Pulleys—Book No. 1622, on cast iron pulleys for power transmission.—Link-Belt Co., 307 North Michigan Ave., Chicago.

Pulleys—Price List P-37-B, of steel split

Paint to Last—and to Increase Light Reflection with

TEXOLITE

NEW PRINCIPLE PAINT



Gives More Coverage Per Quart—More Hiding Power Per Coat

■ For high light reflection and real *economy,* insist on Texolite*, The New Principle wall and ceiling paint. One gallon of Texolite mixed with one-half gallon of water makes one and one-half gallons of ready-to-use paint—*50% more for your money!* In addition, it goes farther—gives more coverage per quart. One coat usually hides completely; dries in one hour; leaves no brush marks. It contains no oil to dim its clear, clean colors, to create "paint odors" or fire hazards. And it is *durable*—will not fade, yellow, crack or peel. Texolite comes in ten pastel shades and white, and in nine Deep Colors which may be used full strength or mixed.

*Registered Trade-mark

FOR YOUR PROTECTION, USG PRODUCTS BEAR THIS ➡ TRADE-MARK IDENTIFICATION UgS

COMPARE Texolite Cost! 1 gal. makes 1½ gals. ready paint.

COMPARE its Hiding Power! High density vehicle makes possible 1-coat hiding.

COMPARE its Satisfaction! Use rooms same day painted. Dries in one hour.

COMPARE its Light Reflection! Texolite white reflects about 90% of light.

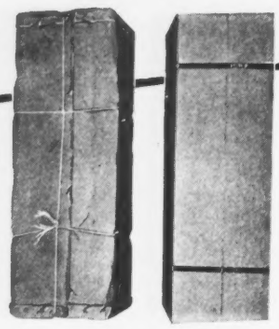
UNITED STATES GYPSUM CO. FMM-10
300 West Adams Street, Chicago, Ill.
Please send Color Guide and literature on Texolite and Textone.

Name .....

Address .....

UNITED STATES GYPSUM COMPANY

PROUD OF YOUR PRODUCT?



LET PACKING AND SHIPPING METHODS SHOW YOUR RESPECT FOR IT

● A sloppy shipment looks as if the shipper cared little for the contents. Companies receiving your goods also receive their first impressions from the condition in which they arrive—from the apparent care with which the packing was done, and the methods and materials chosen to carry them.

APPEARANCE

The safe, sound and economical method for stove shipments in carload lots is Signode "Bulk-Binding." Ask for special bulletin on "Bulk-Binding," when writing.

In that way Signode Tensional Steel Strapping can do a selling job for you. The strong steel straps will reinforce cartons, boxes and crates to guard against crushing and breakage. The Signode Better Packing Engineer who calls on you will cooperate in reaching a safe, low-cost combination of lightweight container and strapping reinforcement.

EXCLUSIVE

The bright red Signode Seals—lithographed with the shipper's trade mark if desired—dress up and identify the package, and hold it secure for a neat, safe and sound arrival. The effect on the customer is one of complete efficiency—right down to the moment of delivery—the best of care for the best of products.

NO EXTRA COST

The finest feature from the shipper's viewpoint is that here at last is something *better looking* that *does not cost more.* It nearly always costs less to ship by the Signode System. Let a Signode representative explain how much less it will cost to pack your product this safer and better way. Write us to have him call.

SIGNODE STEEL STRAPPING CO.
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361 Furman St., Brooklyn, N. Y. — 452 Bryant St., San Francisco, Calif.
Grant Bldg., Pittsburgh, Pa.

SIGNODE
Tensional Steel Strapping

Pulleys—Booklet, on pulleys.—The American Pulley Co., 4200 Wissahickon Ave., Philadelphia.

Pump—Bulletin No. 300, describing portable 2-in., self-priming centrifugal pump.—Homelite Corp., Riverdale Ave., Port Chester, N. Y.

Pump—Bulletin 5592, describing two-stage, built-together pump.—Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago.

Pumps—Catalog L-32, describing IMO oil pumps.—De Laval Steam Turbine Co., Trenton, N. J.

Pumps—Three bulletins: No. 6205, on duplex steam pumps; No. 6920, on oil-lubricated turbine pumps with inclosed impellers; No. 6920R, on water-lubricated turbine pumps with inclosed impellers.—Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago.

Refractory Cement—Bulletin No. R-31, on No. 3000 refractory cement.—Refractory & Insulation Corp., 381 Fourth Ave., New York.

Refrigeration—Booklet, on centrifugal refrigeration.—Carrier Corp., Newark, N. J.

Rheostats—Bulletin 1515, on Jagabi rheostats.—James G. Biddle Co., 1211-13 Arch St., Philadelphia.

Rolling Door—Bulletin 13, on Rol-Top doors.—The Kinnear Mfg. Co., 6000 Fields Ave., Columbus, Ohio.

Setscrews—Bulletin No. 17, on self-locking cap and setscrews.—Dardelet Threadlock Corp., 55 Liberty St., New York.

Shafting—Booklet, on shafting and shafting applications.—La Salle Steel Co., Palmolive Bldg., Chicago.

Switches—Catalog, on Sauter synchronous and electrically wound time switches.—R. W. Cramer & Co., Inc., 67 Irving Place, New York.

Switching Equipment — Two Bulletins: GEA-2023A, on Type TC outdoor group-operated switch; GEA-782D, on outdoor switch houses complete with switching and metering equipment.—General Electric Co., Schenectady, N. Y.

Switches—Two bulletins: GEA-1771A on Type TSA-10 time switches for a.c. circuits; GEA-1285A on two-circuit, 600-volt, a.c. or d.c., cam-operated track-type limit switch.—General Electric Co., Schenectady, N. Y.

Temperature Controls — Catalog, covering line of Klixon thermostatic controls.—Spencer Thermostat Co., Attleboro, Mass.

Tools—Catalog, covering line of wrenches, tool holders, pipe tongs, etc.—J. H. Williams & Co., 75 Spring St., New York.

Tools—Catalog No. 37, on line of saws, saw blades, mallets, and screwdrivers.—The Forsberg Mfg. Co., Bridgeport, Conn.

Unit Heater—Bulletin, describing Lee direct-fired unit heater.—Dravo Corp., Machinery Division, Pittsburg.

Valves—Bulletin GEA-1569A, on Thrustor-operated valves CR9507-B3A and -B3B for pipe sizes 1-10 in.—General Electric Co., Schenectady, N. Y.

Valves—Bulletin No. 461, covering line of Synchro Diaphragm control valves.—The Bristol Co., Waterbury, Conn.

Vibration Damping—Booklet, title "Eliminating Vibration Losses."—The Korfund Co., Inc., 48-15 32d Place, Long Island City, New York.

Welder—Bulletin GEA-2447C, describing G-E Mutator arc welder.—General Electric Co., Schenectady, N. Y.

Welder—Catalog Section 26-320, on Midget Marvel Flexarc Welder.—Westinghouse Electric & Mfg. Co., East Pittsburgh.

Welding—Wall chart, showing symbols for working drawings, types of joints for arc welding, and other information for arc welding design.—The Lincoln Electric Co., Cleveland.

Welders—Catalog 38W, on spot and butt welding machines.—Eisler Engineering Co., 750 South 13th St., Newark, N. J.

Winder Drives.—Bulletin GEA-1745A, on winder drives with adjustable voltage and automatic tension control.—General Electric Co., Schenectady, N. Y.

Wire Rope — Catalog CCB-2, showing Crosby wire rope clip.—American Hoist & Derrick Co., St. Paul.

SMALL Investment— BIG Return!

★ **Work Speeded**

★ **Space Saved**

★ **Accidents Prevented**

If you could make an extra profit by doing away with scattered and inaccessible boxes of parts and materials — wouldn't you do it? . . . You can make such a profit *in a short period* with STACKRACKS!

STACKRACKS save valuable floor space by storing boxes vertically. Save time by keeping each box instantly accessible; its contents as easy to reach as those of your desk drawer. Save the labor required to pile and unpile boxes, and the accidents that unsteadily-piled boxes can cause.

Individual racks of channel-formed steel—one to fit each box—are locked together securely, quickly, without tools, to form a STACKRACK unit of any size and shape. Find out how small an investment will bring this big return to your plant! Write today for descriptive literature.

STACKRACKS
A Product of Stackbin Corp.
"Stacked and still accessible"
69 Troy St., Providence, R. I.

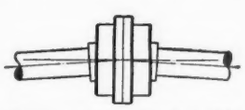
Now—A Flexible Coupling that's

The ONLY Coupling on the Market that Takes Care of ALL FOUR Drive Conditions Without Increasing Bearing Loads!

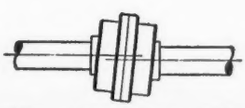
Here's a flexible coupling that's *more* than merely a coupling. Most couplings on the market take care of two or possibly three direct drive conditions and only when present to a *slight* degree. The RYBECK coupling is of full-floating, semi-universal joint design — *flexible in all directions.* It takes care of ALL FOUR drive conditions even when present to an *excessive* degree and without increasing bearing loads.

Why be satisfied with a coupling that only *partially* solves your direct drive problem when you can get a RYBECK full-floating coupling at no greater cost? Time-tested and manufactured by the T. L. Smith Company, a nationally known leader in its field for the past 37 years. Before you specify—investigate this better coupling. Write for bulletin.

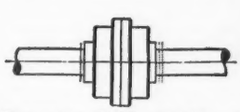
The T. L. SMITH CO., 2812 N. 32nd St., Milwaukee, Wis.

1 

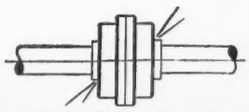
Allows for excessive ANGULAR misalignment of shafts.

2 

Allows for excessive OFFSET misalignment between shafts.

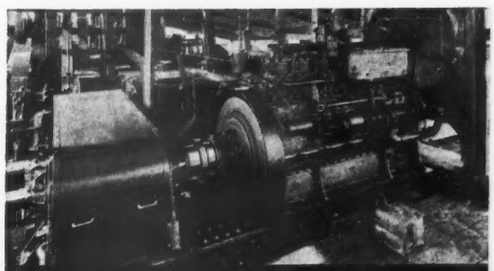
3 

Permits END PLAY of shafts with minimum resistance.

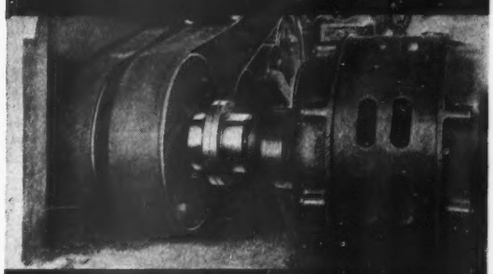
4 

Absorbs and Smoothens out SHOCKS and Vibrations in the drive.

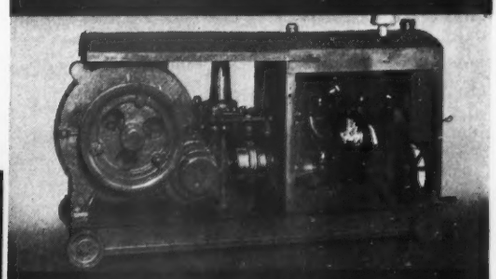
RYBECK
TRADE MARK
FLEXIBLE COUPLING



OIL DRILLER—5" Rybeck Coupling installed on 275 h.p. oil drilling rig in Olkahoma.



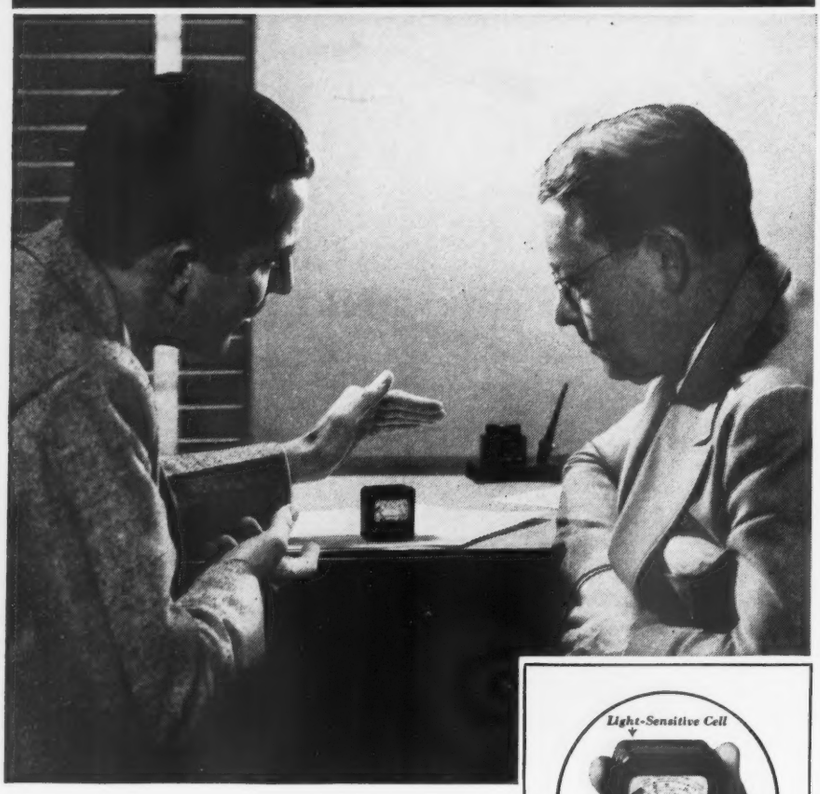
LUMBER MILL—Rybeck Coupling giving heavy duty service in a large midwest lumber mill.



HOIST—A 2¼" Rybeck Coupling used in transmitting power to an auto hoist unit.

A 2093-1PC (1037)

2 WAYS TO GET ALL THE LIGHT YOU PAY FOR



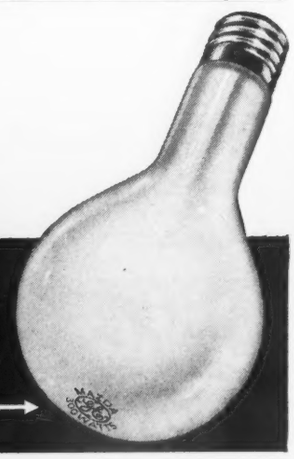
CHECK YOUR LIGHTING

With a General Electric Light Meter . . . that measures light as simply as a thermometer measures temperature . . . you can easily tell whether your plant and office are getting enough light for safe, easy seeing. The G-E Light Meter is priced at only $11.50.

Here are two simple ways to be sure that you are getting all the light you pay for:

1. Have the lighting in your plant and office checked by your local lighting company to make sure you are getting the most efficient use of the light you buy. A survey by a lighting expert, equipped with a G-E Light Meter, may reveal that there is not enough light for safe, easy seeing in certain parts of your plant. Very often, a few simple changes can be made that will enable you to use the electricity you pay for much more efficiently.

2. When you buy bulbs, get the new and brighter G-E MAZDA lamps. They actually give you more light than the lamps of a year ago without using any additional current. And they *stay brighter longer* than ever before. This is because the constant improvement and technical development made in General Electric lamp research laboratories is continually raising the efficiency of G-E bulbs year after year. That's why the trade-mark (GE) on these bulbs assures you of getting full lighting value for your money. General Electric Company, Nela Park, Cleveland, Ohio.



GENERAL (GE) ELECTRIC
MAZDA LAMPS
They stay brighter longer →

BOOKS

THE SCIENCE OF VALUATION AND DEPRECIATION

Edwin B. Kurtz, Professor and head of the Electrical Engineering Department, The State University of Iowa. The Ronald Press Co., 15 East 26th St., New York. 221 pages, appendix, charts, index. $4.50.

To show the application of mortality laws of physical property in estimating and accounting, this book offers scientific solutions, based on life experience tables, to basic problems in valuation and depreciation estimating and accounting. It deals with determination of average life of any class of property, of life expectancy, annual and accrued loss of service life, annual renewals necessary, and so on. Included are 65 curves giving life experience data of different types of equipment.

PRINCIPLES OF ACCOUNTING

Alva L. Prickett, Professor of Accounting, Indiana University, and R. Merrill Mikesell, Assistant Professor of Business Administration, Indiana University. The MacMillan Co., 60 Fifth Ave., New York. 519 pages, index. $3.50.

Revised edition of the book originally published under the title "Introduction to Accounting." Some chapters have been rewritten and whole new ones have been added to bring it up to date. It gives comprehensive treatment to the subject of general accounting, and has an abundance of illustrative material.

MODERN MANAGEMENT

J. E. Walters, Ph. D., Director of Personnel, Schools of Engineering; Professor of Personnel Administration, Purdue University. John Wiley & Sons, Inc., 440 Fourth Ave., New York. 337 pages, index. $3.

To present the methods of modern management and the application of the scientific method to the various phases of that management, this book has been written. It is not a critical analysis of industrial methods, but aims rather to give the procedures which modern managers are using in running their companies. There are chapters on the meaning of modern management, historical background, methods, money, men, materials, manufacturing, marketing, and measurements.

•

ON THE CALENDAR

OCTOBER

4-6, Fall Meeting, American Society of Mechanical Engineers, Erie, Pa. C. E. Davies, Executive Secretary, 29 West 39th St., New York.

4-9, Chicago Exposition of Power and Mechanical Engineering, Chicago. Charles F. Roth, Vice-President, International Exposition Co., 480 Lexington Ave., New York.

11-15, National Safety Council, Annual Meeting, Kansas City, Mo. W. H. Cameron, Secretary and Managing Director, 20 North Wacker Drive, Chicago.

15-17, Annual Convention, National Association of Foremen, Detroit. E. H. Tingley, Secretary, 11 West Monument Bldg., Dayton, Ohio.

18-22, American Society for Metals, National Metal Congress and Exposition, Atlantic City, N. J. W. H. Tisenman, Secretary, 7016 Euclid Ave., Cleveland.

24-29, National Electrical Manufacturers Association. Annual Meeting, Chicago. W. J. Donald, Managing Director, 155 East 44th St., New York.

DECEMBER

6-10, Annual Meeting, American Society of Mechanical Engineers, New York. C. E. Davies, Executive Secretary, 29 West 39th St., New York.

6-11, Sixteenth Exposition of Chemical Industries, New York. Charles F. Roth, International Exposition Co., Grand Central Palace, New York.

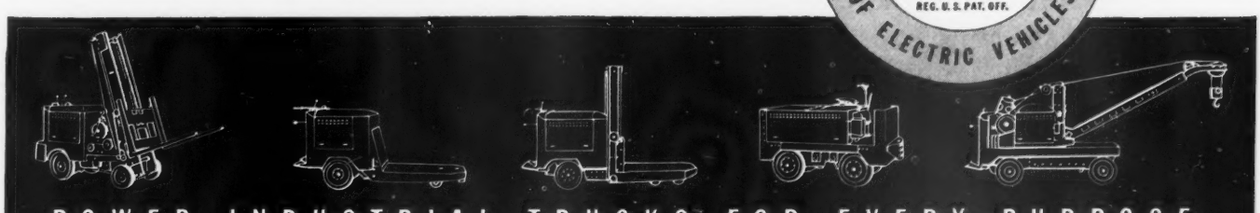
9-10, Annual Conference, The Society for the Advancement of Management, New York. Evelyn Buckley, Assistant Secretary, 29 West 39th St., New York.

FAST WORK..

In the faster operation and lowered costs so essential to profits today, Baker Industrial Trucks are making a secure place for themselves. Especially designed for heavy duty use, these sturdy units are writing highly satisfactory records of time and cost savings in all types of industrial work. Sound construction and low maintenance requirements are enabling plant owners to hold these savings through years of day-in-day-out operation.

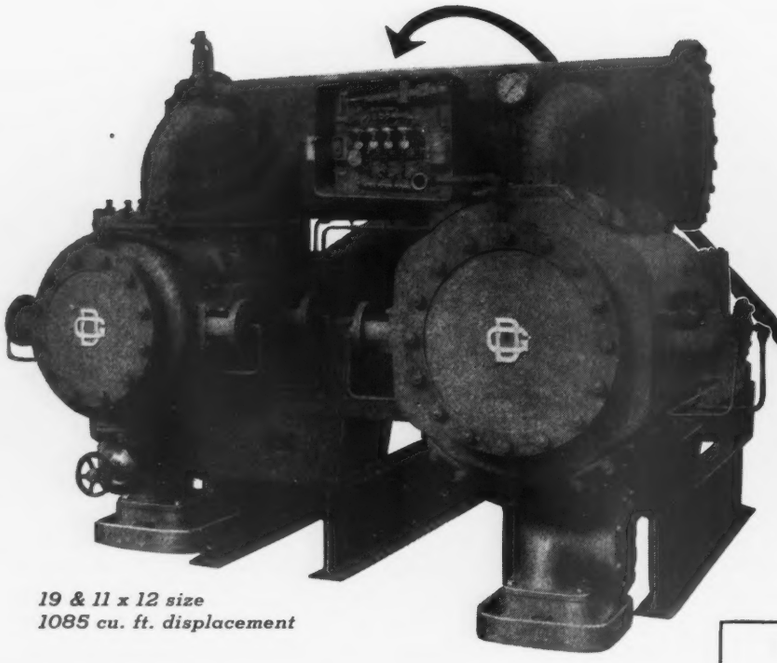
The Baker Materials Handling Engineer can bring you accurate data and records of savings effected in hundreds of plants. You'll find his information helpful in the study of your own handling problems. Write for complete information. BAKER INDUSTRIAL TRUCK DIVISION *of the Baker-Raulang Company,* 2178 W. 25th St., Cleveland, Ohio.

OLDEST MANUFACTURER
Baker
TRADE-MARK REG. U. S. PAT. OFF.
OF ELECTRIC VEHICLES



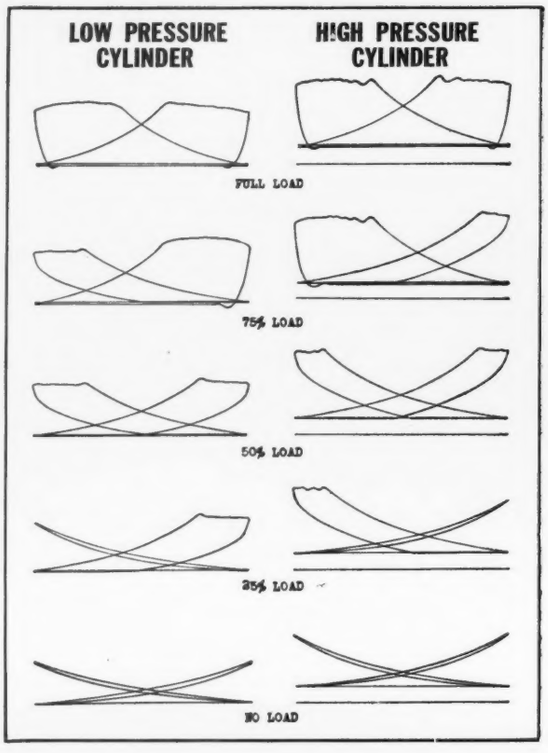
POWER INDUSTRIAL TRUCKS FOR EVERY PURPOSE

GARDNER-DENVER *Five Step* CAPACITY CONTROL BRINGS INCREASED ECONOMY IN OPERATING LARGE COMPRESSORS



19 & 11 x 12 size
1085 cu. ft. displacement

FIVE-STEP MAGNETIC CONTROL



The Five-Step magnetic control provides a positive, reliable means of assuring efficient and economical part-load operation, as shown by the diagram on this page. In addition, this construction minimizes power-line disturbances, cushions inertia forces of reciprocating parts and reduces bearings loads.

The Magnetic Control and motor starting equipment are so connected electrically that they operate as a single unit. If motor is de-energized either intentionally or accidentally, compressor stops in unloaded position. When re-starting, compressor will be unloaded until after motor is re-synchronized.

Five-step capacity control is only *one* of the many advantages which make Gardner-Denver "HA" Horizontal Compressors a better buy. The ONLY Duplex Two-Stage Horizontal Compressor regularly fitted with double-taper roller main bearings.

GARDNER-DENVER COMPANY
SINCE 1859 Quincy, Illinois

GARDNER-DENVER

For Underfoot Efficiency . . .

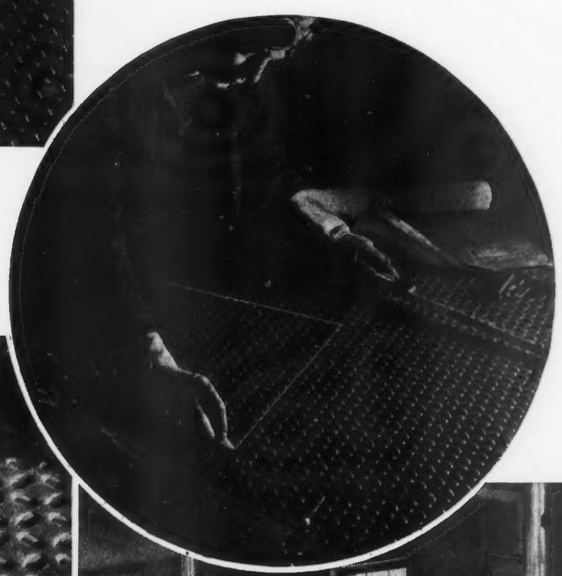
Get

MULTIGRIP FLOOR PLATE

Multigrip Floor Plate provides a wear resisting floor surface which helps prevent accidents due to falls. The symmetrical design of its risers offers many added advantages, and you can get these advantages at no extra cost, for Multigrip costs no more than ordinary floor plate.

FOR SAFETY

The risers of Multigrip Floor Plate are designed to give protection against slips and falls even when the flooring is wet.

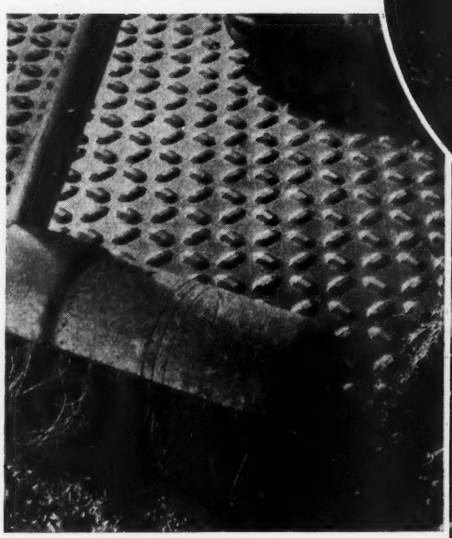


FOR ECONOMY

The Multigrip Floor Plate pattern is designed so that it will "match up" no matter how it is cut. This symmetrical design minimizes waste in cutting, makes Multigrip Floor Plate go farther.

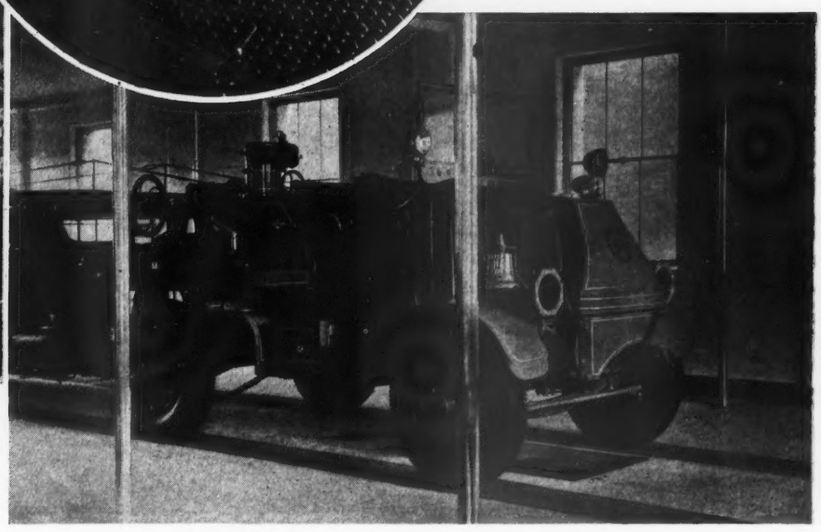
FOR VERSATILITY

There are hundreds of ways in which Multigrip Floor Plate can serve you economically and efficiently. This photograph shows how six of Chicago's Fire Stations have used Multigrip Floor Plate to their advantage.



FOR CLEANLINESS

There are no pockets to collect dirt in Multigrip Floor Plate. Just sweep and it comes clean. The risers are so designed that a hose or brush can drive the dirt in any direction.



U·S·S MULTIGRIP FLOOR PLATE

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

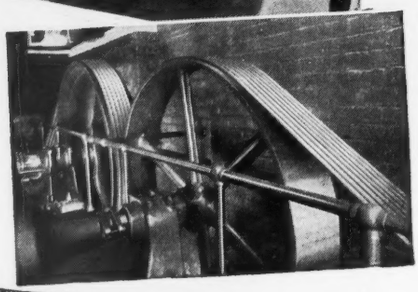
UNITED STATES STEEL

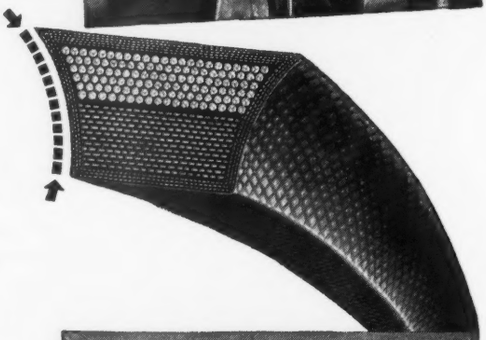
Make this **TEST**

See for Yourself . . . . THE *Importance* OF THE Concave Side

Bend **any** V-Belt and **feel** it change shape. The top, under tension, **narrows.** The bottom widens. The sides of the belt bulge out. The result is a shape that does not fit the sheave groove—as shown in Figure 1, below.

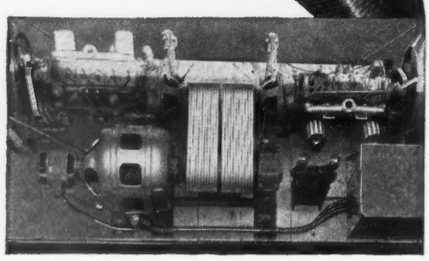
FIG. 1 FIG. 2





Now, bend a V-Belt built with the patented **Concave** side. You get the **same** shape change but **now** the new shape **exactly** fits the sheave groove—as shown in Figure 2. There is no side-bulge. Results? (1) **Uniform** side-wall wear; **longer** life! (2) Full side-wall grip on the pulley means no slippage; saves belt wear and **power!**

The Gates Vulco Rope is the only V-Belt built with the patented concave side.



Engineering Offices and Stocks in All Large Industrial Centers

THE GATES RUBBER COMPANY

Factory Branches

Terminal Building
Hoboken, N. J.

1524 So. Western Ave.
Chicago

741 Warehouse St.
Los Angeles

2213 Griffin Street, Dallas

999 South Broadway, Denver

GATES VULCO ROPE DRIVES

● **The completeness of the DeVilbiss Spray-Finishing System is well illustrated by the extensive line of standard DeVilbiss Spray Guns.**

The DeVilbiss New Type MBC Spray Gun is, of course, the accepted gun for most all common production finishing operations and materials.

But some operations and materials require spray-gun performance not common to general production finishing, while others do not require the superlative performance of such an advanced gun as the all-purpose Type MBC. And for practically every one of these exceptions to the general rule, there is a gun within the standard DeVilbiss line that will fill the needs of the work to be done.

And further, should any material or operation prove so exceptional that requirements cannot be met by one of the standard guns, DeVilbiss is prepared to meet this problem with a specially designed gun.

This completeness of equipment is carried out not only in spray guns, but throughout the entire DeVilbiss Spray-Finishing System. Whatever your own finishing problem, DeVilbiss is equipped to provide an installation exactly suited to your individual requirements.

The DeVilbiss Company, Toledo, Ohio

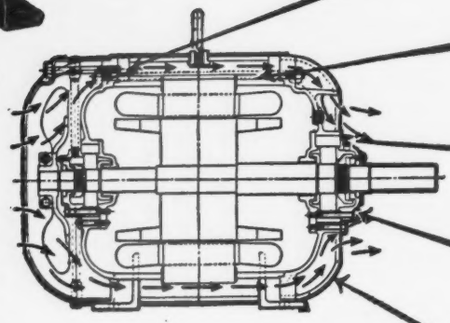
DeVilbiss

SPRAY GUNS · REGULATORS · SPRAY BOOTHS · EXHAUST FANS · AIR COMPRESSORS
MATERIAL CONTAINERS · HOSE AND CONNECTIONS · ACCESSORIES

Wagner Type CP Motors
Require Minimum Maintenance

HERE'S WHY!

Examine the cross-section of a Wagner type CP totally-enclosed fan-cooled motor and see why this motor, year in and year out, under all types of atmospheric conditions, will continue to carry the load—free from unnecessary shutdowns and maintenance.



Note the following salient features of design:

1. It is provided with two frames—an outer frame which guides a strong cooling draft over the motor—and an inner frame which prevents anything obstructive or injurious from getting into the motor.

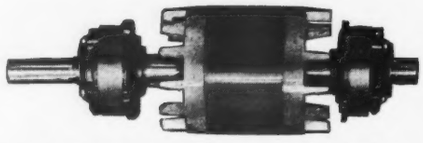
2. Rugged, welded all-steel stator with specially impregnated and fully taped winding, and deeply grooved periphery to increase radiating surface.

3. Easily accessible grease plugs on both ends of motor with special arrangement on fan end to permit lubrication without removing fan shield and without shutting down the motor.

4. Full cartridge-type bearing construction which completely seals and protects the ball bearings.

5. End-plates direct the ventilating air against the bearings, keeping them very cool.

Wagner Type CP stator—built to meet the exacting requirements of hard, continuous service.



Wagner Type CP rotor—balanced to insure freedom from vibration; cast aluminum blowers, bars and rings; built substantially to operate smoothly, efficiently and dependably.

There are many other features of superiority of Wagner type CP motors. Write today for your copy of Bulletin 182, Part 4C.

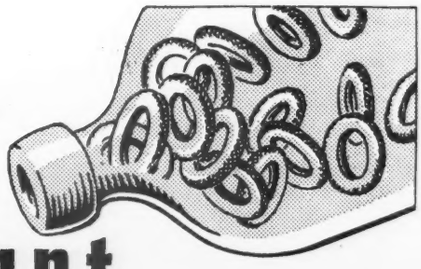
Wagner Electric Corporation

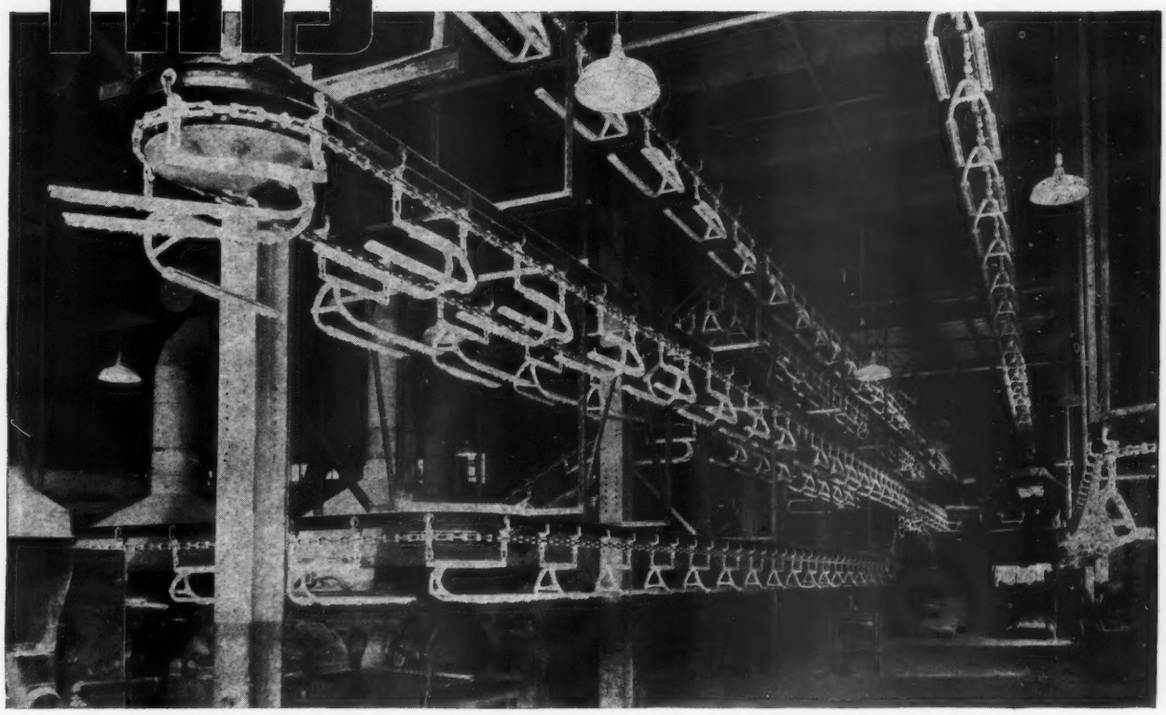
6400 Plymouth Avenue, Saint Louis, U.S.A.

ML 337-2D

MOTORS • TRANSFORMERS • FANS • BRAKES

No "BOTTLE-NECKS" in THIS Tire Plant





No bottlenecks in this big, new Los Angeles plant. Lamson Overhead Conveyor shown here handles slabs of rubber in process.

NEW—modern in every detail—this Pacific Coast plant of the Goodyear Tire & Rubber Company made provision from the very start to eliminate the slow spots, the troublesome "bottle-necks" that slow up the even flow of production.

Lamson Conveyors were specified, of course. Notice the special provision made in the overhead Lamson chain conveyor shown in the illustration for a steady flow of huge slabs of rubber through progressive stages of manufacture.

Lamson Conveyors lift the burden of trucking, handling and re-handling of materials from the shoulders of skilled labor. They permit workmen to give full time and attention to skilled work—and they eliminate the costly delays and pile-up of materials which come from "bottle-necks" or slow spots occuring in the production line.

Why not let a Lamson engineer survey your plant for the existence of these troublesome spots. Backed by 50 years of specialized experience . . . by a complete line of conveying equipment . . . Lamson engineers are frequently able to suggest profitable improvements at little cost. No obligation for consultation. Check and mail the coupon or ask for a free copy of our Conveyor Book.

LAMSON CONVEYORS

THE LAMSON COMPANY, Inc.
Syracuse, N. Y.

☐ Send me a Free Copy of your 24-page book on Lamson Conveyors.
☐ Have your engineer call.

Name .....
Company .....
Address .....

GREASY GLOBBO

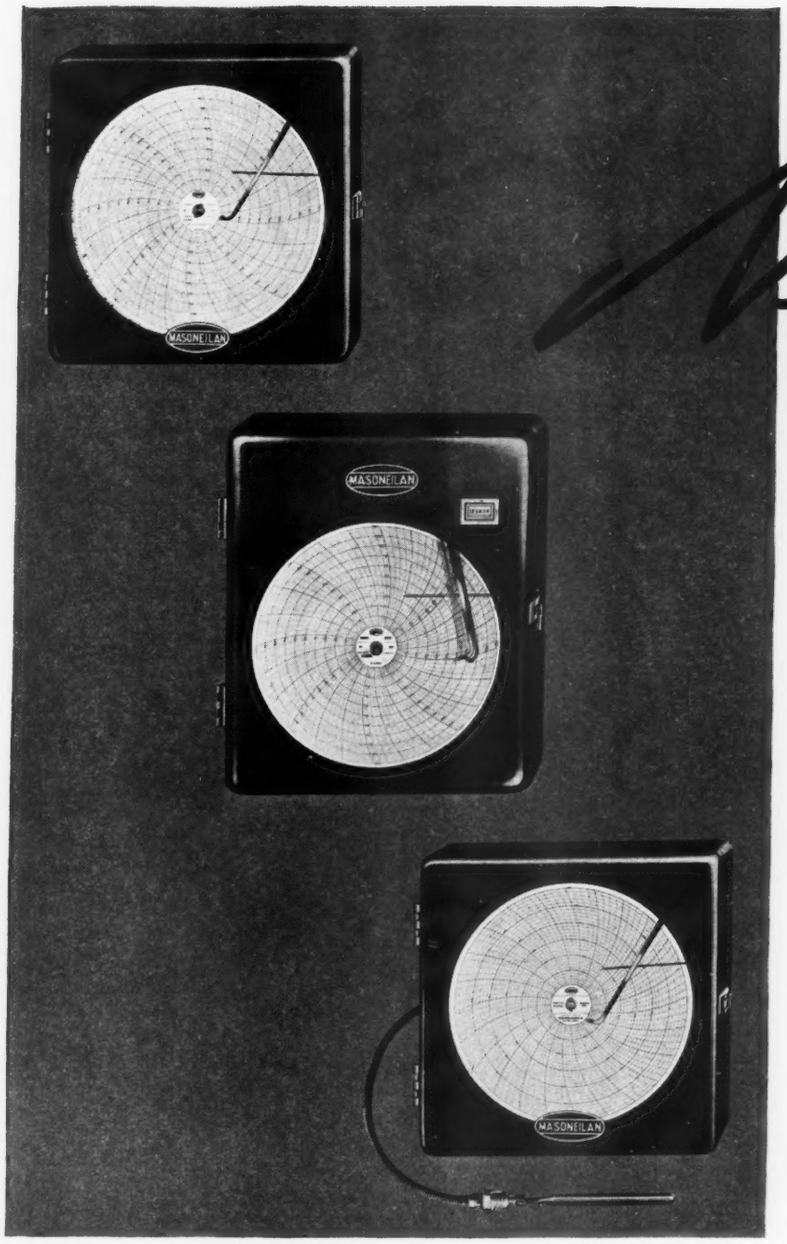
This slippery offspring of oil and grease likes nothing better than to ooze his gooey glob all over any piece of insulated wire he can land on. If he isn't wiped away he knows he can penetrate ordinary insulation and break it down so that it's just about as good dielectrically, as a piece of screen cloth. And it isn't long after that when the "shorts" start popping.

But, you can stop the trouble before it starts with Rockbestos. It can be saturated with oil and grease and still stay on the job because it's made of something that won't break down . . . *asbestos.* If you want to satisfy yourself, use Rockbestos in the same installations where other wire has failed and you'll see what a real *lasting insulation* is.

One of our more than fifty standard heat resisting wires, cables or cords may solve your problem. If not, our research laboratory will be glad to work on it without obligation. For information, samples or a catalog write Rockbestos Products Corporation, 863 Nicoll Street, New Haven, Conn.

Also refer to Electrical World Buyer's Reference Number of Dec. 19, 1936. Part II.

ROCKBESTOS A.V.C.—*the wire with permanent insulation*



GET THE *News* THAT FIGURES IN THE BALANCE SHEET

MASONEILAN

PRESSURE
TEMPERATURE
RATE OF FLOW
LIQUID LEVEL

RECORDERS AND INDICATORS

On tanks, vats, kettles, ovens, stills; steam, water, oil and gas lines; in power house and industrial mill; anywhere pressure, temperature, rate-of-flow or liquid level are factors in plant operation Masoneilan Recorders get essential information — get it accurately and in the most convenient form, for immediate use or future reference.

Models available include manometer type flow meters, with or without integrator; transmitter type and float type liquid level recorders; pressure gauges with a wide variety of ranges between 30″ vac. and 10,000 lbs.; thermometers, with ranges between minus 100° and 1100° F., equipped with the famous Masoneilan "floating" movement.

Valuable features of design and construction available in no other recorders, make these Masoneilan instruments outstanding. Precision workmanship and rugged construction assure their accuracy and long life. Complete information and bulletins sent promptly on request.

MASON-NEILAN REGULATOR COMPANY, 1194 ADAMS STREET, BOSTON, MASS., U. S. A.

New York Philadelphia Pittsburgh Chicago St. Louis Tulsa Houston Los Angeles

NOW YOU GET

3 new advantages

in the famous Jenkins Standard Bronze Valves

CONSTANTLY, Jenkins Bros. strives to attain perfection in Standard Bronze Valves. The three new features presented here are the result of our latest effort to that end. Together they add even greater convenience and better service to the famous valves which thousands of valve users already consider "perfect".

A NEW HANDWHEEL is the most apparent of the features. Put your hand on it . . . you'll say it affords the best grip and protection from burn of any valve wheel.

A NEW VALVE INDEX PLATE . . . telling figure number and also the disc number and service . . . is an important time and trouble saver in ordering replacements.

A REMARKABLE NEW DISC that offers unheard of life in steam service is made available. Designated as No. 119-A, it replaces disc No. 119.

Our new folder on Standard Bronze Valves tells all about these and other features which have made "Jenkins" preferred among valve users. Write for it.

JENKINS BROS., 80 White St., New York; 510 Main St., Bridgeport; 524 Atlantic Ave., Boston; 133 N. Seventh St., Philadelphia; 822 Washington Blvd., Chicago; JENKINS BROS., Ltd., Montreal, Can.; London, Eng.

NEW CONVENIENCE!

Scientifically correct design makes any size wheel fit any size hand. See the extra-gripping area in the deep scallops. See the depressed center that prevents the hand from touching a hot wheel nut. The non-heat design is not bulky, but made of superior malleable iron it stands a wrench.

The Index Plate, held by the wheel nut, is of aluminum with bright markings etched in green enamel.

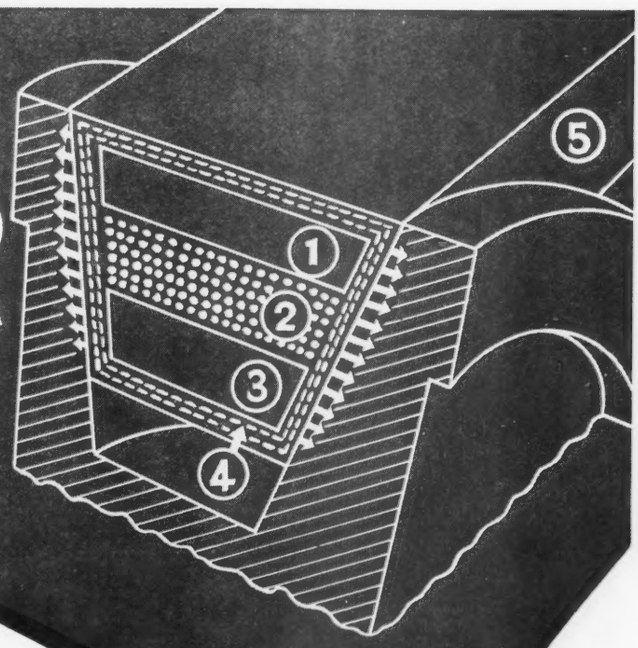
UNHEARD-OF DISC LIFE!

Two years' service tests show that our new No. 119-A Disc, when used in the service for which it is recommended, will outlast any other composition disc we know about, including hard rubber and Bakelite. This new disc replaces No. 119 and is recommended primarily for steam service, although we believe it to be the nearest thing to a "universal" disc that has ever been developed.

JENKINS VALVES

BRONZE—IRON—STEEL

Plan for POWER with



Gilmer "V's"

Gilmer grip can't slip

Belt engineers build Gilmer V-Belts. Gilmers are "tailor-made in the grooves," on the world's largest assortment of V-moulds. Gilmers fit — *have* to fit. Only Gilmers have *Gilmer grip.*

***Gilmer grip* multiplies pulling power. You see why here:**

A Gilmer V-Belt's *straight sides* bulge along their whole width, as the belt flexes around the sheave, whose steel sidewalls distribute this bulging over both side surfaces of the belt. (Arrows indicate area.) Thus, two whole sides *push* and *press*, and *grip* the sidewalls. Lateral stress, across the belt's full thickness, locks the Gilmer in working position. Pressure prevents slippage. Pressure creates pulling power. That pressure is *Gilmer grip.*

***Gilmer grip* makes Gilmer "V's" do faster, cheaper work. Cuts out waste. Cuts down costs. Steps up the delivered power you get (the power you're paying for!). Get Gilmers on the job right now... FREE Gilmer Catalogue filled with facts.**

GILMER'S 5 FAMOUS FEATURES

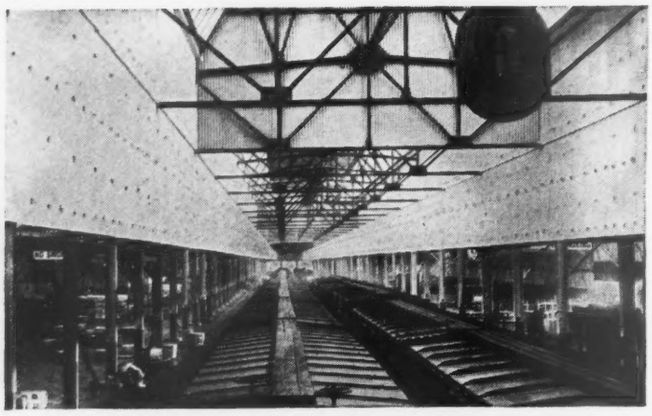
1. **Top Rubber (Tough and resilient)**
2. **Pulling Cords (Locked in rubber; patented construction)**
3. **Bottom Rubber (Heat-resisting; developed by Gilmer)**
4. **Double Jacket (Triples working life of belt)**
5. **Controlled Stretch (Permanently matched working lengths)**

Gilmer BELTS

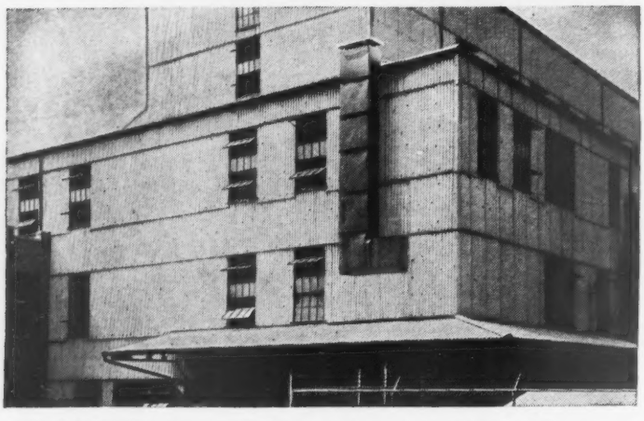
L. H. GILMER COMPANY, Tacony, Philadelphia
The Oldest Firm of Rubber Fabric Belt Specialists

Plan POWER on f. h. p. jobs with Gilmer Single-Strand V-Belts

Write LOW-COST MAINTENANCE into your specifications...



FIRE-INSURANCE rates are often lowered when Corrugated Transite is used. In this pier shed, smoke baffles and fire stops made of this fireproof material eliminate the danger of flying sparks.



NO PAINTING necessary! Eliminate this major budget item by specifying J-M Corrugated Transite Roofing and Siding . . . the permanently weatherproof building material for all industrial purposes.

by selecting Johns-Manville CORRUGATED TRANSITE ROOFING AND SIDING . . . then you can expect years of service at practically no expense for maintenance!

YEARS OF MAINTENANCE-FREE SERVICE in this coke plant is assured by Corrugated Transite. Asbestos-cement in composition, it offers unusual protection against corrosion, and is fireproof and weatherproof as well.

IT'S HARD TO JUSTIFY continued high maintenance charges on roofing and siding—when Johns-Manville offers a lasting material that keeps these costs at rock bottom!

This durable roofing and siding . . . J-M Corrugated Transite . . . is made of two imperishable minerals—asbestos and Portland cement—molded under tremendous pressure into monolithic sheets. When you erect these sheets . . . applied as rapidly and easily as wood or metal . . . your roofs and sidewalls are corrosion-resistant, fire-safe and thoroughly immune to destruction by rot, weather or severe temperature changes!

Performance reports on J-M Corrugated Transite include records of 10 to 15 years' successful resistance to salt, acid and corrosive vapors. Moreover, these installations, like others made over 20 years ago, are still good for many years more!

That's why industrial plants everywhere are specifying this material. Wherever it goes up, it means that maintenance costs, for years to come, will be held to an absolute minimum.

For full information on Corrugated Transite Roofing and Siding, send for our new illustrated brochure. It also contains details on J-M's unique water-tight construction method. Johns-Manville, 22 E. 40th Street, New York, N. Y.

Johns-Manville

Corrugated Transite Roofing & Siding

Keep Work Flowing with American Goggles

When a flying chip makes contact with an eye, it *breaks contact* on the machine . . . shuts it down for an indefinite time.

And the instant the machine stops, cost-losses start. Compensation costs run high. If an injury is prolonged and complicated by a latent eye-disease there is extra expense. To this, add loss of time and output . . . slowdown on production by fear-struck witnesses of the accident. Plus administrative and clerical costs. Total — an untold sum.

This is the risk that's run — *for lack of a dollar's worth of eye-protection.* And it's a risk that materializes in disaster, sooner or later, wherever endangered eyes go unprotected. It's much more profitable — *more humane* — to call in the neighboring American representative and have him search out all the blind spots in your plant . . . have him plan and install a *complete* eye-protection program. Have your Safety Director call the nearby American branch today.

F-3100 Ful-Vue Goggles (patented) are cool, comfortable, good-looking. High endpieces remove "blinders" to side-sight. 6-Curve Super Armorplate Lenses provide far more strength than standard lenses.

AMERICAN OPTICAL COMPANY

Manufacturers, for more than 100 years, of products to aid and preserve vision. Factories at Southbridge, Mass. In Canada, Consolidated Optical Co., Ltd. Branch Offices in all principal industrial centers.

4188

LIGHTING ABC's

for Heavy Service Industries

The New Millite

To solve the acute problem of providing a heavy-duty lighting unit for heavy service industries, Westinghouse now offers the new MILLITE.

Dust-tight and vapor-proof, this industrial lighting unit is specifically designed for use in high-bay areas where atmospheric and general service conditions are too severe for ordinary open-type reflectors . . . where lighting equipment must meet the most rigorous tests of operation and use.

With a heat and impact resisting glass lens cover protecting the reflector surface from dust and corrosive vapors, Millite combines maximum mechanical ruggedness with sustained lighting efficiency.

Get all the facts on Millite from your local Westinghouse Jobber Lighting Specialist, or address Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, Ohio.

BLE TO STAND PUNISHMENT. The Millite steel reflector housing is finished with special acid-resisting multi-coat green enamel, baked at an extremely high temperature for permanence. This combination of sturdy structural strength and durable finish, together with a well-rounded contour, gives Millite exceptional resistance to shock and abuse. The lens is capable of resisting extraordinary impact and is impervious to sharp temperature changes.

RILLIANT LIGHT SOURCE. Because of an improved aluminum reflector design and its Alzak finish, the Millite *light*-directing medium delivers more than 80% of the bare lamp lumens to the working plane. The semi-specular type reflector is smooth Alzak processed aluminum, and is intended for mounting heights of 30 feet to 45 feet. The specular type reflector is dimpled Alzak processed aluminum highly polished, and suitable for mounting heights above 45 feet.

ONVENIENT TO CLEAN. Millite solves the lighting maintenance problem in heavy service industries. Complete lighting efficiency is restored merely by wiping off the outside of the cover glass. The removable reflector, non-freezing lamp socket, smooth well-rounded housing and easy-operating hinged cover with flat, highly polished and tempered glass, minimize over-all upkeep. Millite can be cleaned any time of night or day without interrupting service.

WHEN YOU THINK OF *Lighting* THINK OF

W WESTINGHOUSE ELECTRIC

Westinghouse

NO STRETCH
NO SLIPPAGE
after 3 years on the main drive

That's the service history of this Thermoid No. 436 Friction Surface Transmission Belt in a bustling Michigan paper mill, and the belt is still going strong.

This record is by no means exceptional. Thermoid Belting has done the same for hundreds of others — will do the same for you. That's true because several generations of continual development work with belt fabrics, friction compounds, and constructions are responsible for the excellent service which Thermoid Belting gives.

If you are interested in better belt performance, write direct to us for complete information and recommendations.

THERMOID RUBBER
Division of Thermoid Co.
TRENTON, NEW JERSEY

Thermoid

BELTING · HOSE · PACKINGS · BRAKE LININGS

New Oxweld Cutting Blowpipe

TYPE C-31

for low- or medium-pressure acetylene

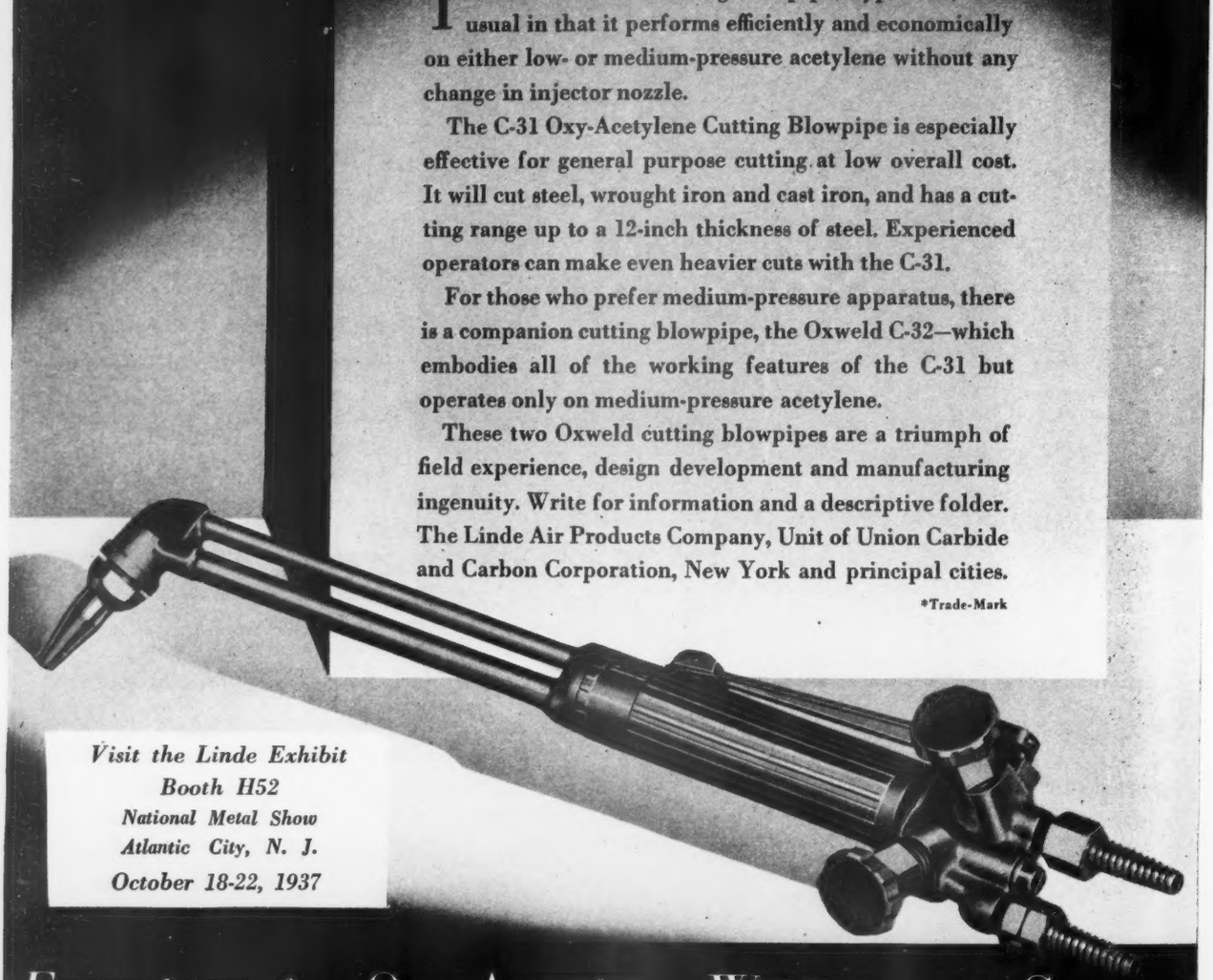
THE new Oxweld* Cutting Blowpipe, Type C-31, is unusual in that it performs efficiently and economically on either low- or medium-pressure acetylene without any change in injector nozzle.

The C-31 Oxy-Acetylene Cutting Blowpipe is especially effective for general purpose cutting at low overall cost. It will cut steel, wrought iron and cast iron, and has a cutting range up to a 12-inch thickness of steel. Experienced operators can make even heavier cuts with the C-31.

For those who prefer medium-pressure apparatus, there is a companion cutting blowpipe, the Oxweld C-32—which embodies all of the working features of the C-31 but operates only on medium-pressure acetylene.

These two Oxweld cutting blowpipes are a triumph of field experience, design development and manufacturing ingenuity. Write for information and a descriptive folder. The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, New York and principal cities.

*Trade-Mark

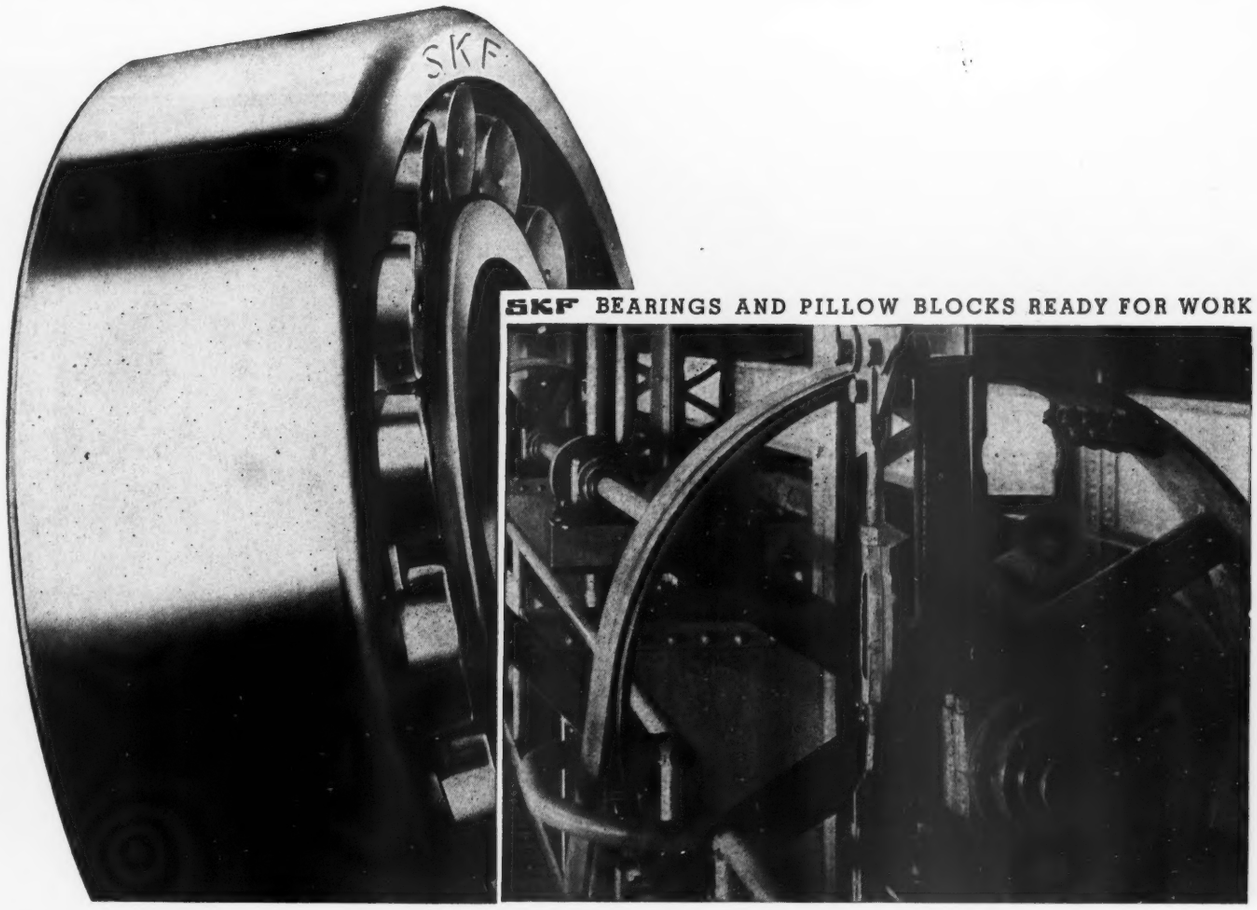


Visit the Linde Exhibit
Booth H52
National Metal Show
Atlantic City, N. J.
October 18-22, 1937

Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES FROM LINDE UNION CARBIDE

PRODUCTS OF UNITS OF UCC UNION CARBIDE AND CARBON CORPORATION



SKF BEARINGS AND PILLOW BLOCKS READY FOR WORK

Men who sell SKF Pillow Blocks know how

TO KEEP COSTS DOWN

The SKF Pillow Blocks in this illustration are merely a reminder that your nearest SKF distributor can be one of your best friends.

He stands ready to help you fight costly production delays by recommending one or more of many types and sizes of SKF Bearings and Pillow Blocks for your particular needs.

He can show you how SKF Bearings and Pillow Blocks on shafts with diameters from 5/8" to 30" often save enough power, maintenance and lubrication to pay for themselves within two years. It will pay you to get acquainted with him.

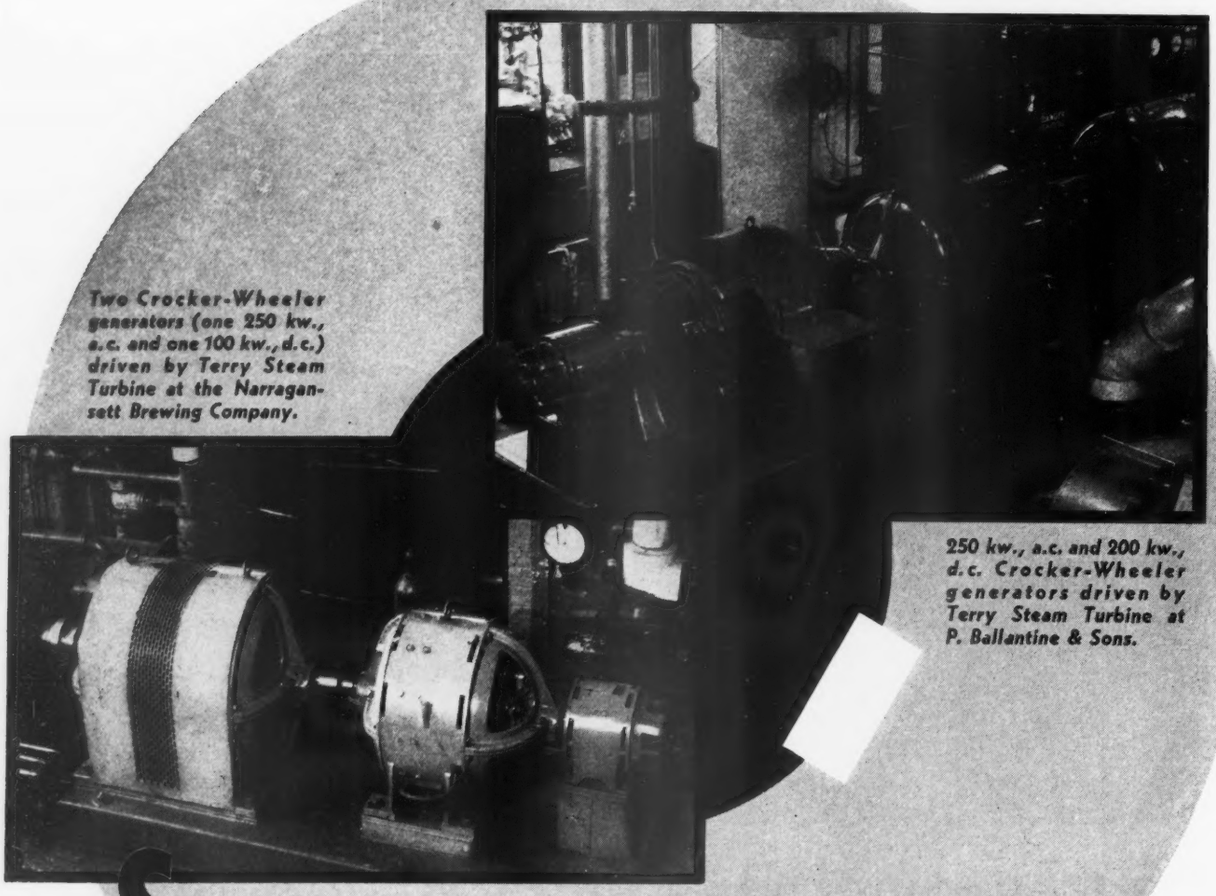
3949

MORE THAN
1200
TYPES AND SIZES
Industry comes to SKF for unbiased bearing counsel because SKF makes practically all types of anti-friction bearings.

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

SKF

BALL AND ROLLER BEARINGS



Two Crocker-Wheeler generators (one 250 kw., a.c. and one 100 kw., d.c.) driven by Terry Steam Turbine at the Narragansett Brewing Company.

250 kw., a.c. and 200 kw., d.c. Crocker-Wheeler generators driven by Terry Steam Turbine at P. Ballantine & Sons.

Since the repeal of Prohibition

a number of breweries have considered it advisable (in view of the economies that could be effected) to install their own generating plants. Savings are obtainable in breweries partly because of the demand for process steam which can be bled from the turbines driving the generators.

However, comparable economies can be effected in a wide variety of buildings and industrial plants particularly where there is a demand for heat, hot water or process steam.

The installation of generating equipment may be able to lower your power costs too. Why not ask Crocker-Wheeler engineers to submit recommendations?

CROCKER-WHEELER

TRADE MARK REG. U.S. PAT. OFF.

EXCELLENT ENGINEERING

CROCKER-WHEELER ELEC. MFG. CO.

Main Office and Works: AMPERE, N. J.

SALES OFFICES IN PRINCIPAL CITIES

The GREATEST HAT TRICK ever pulled

Hat manufacturers turn climate into cash. By putting Certified Climate into their plants they get money out of their hats. For under measured atmospheric conditions — proper temperatures and controlled humidities—hat production improves. Workability of fur is better. Sizes run truer. Rejects are fewer. Profits pull ahead.

You can't call it magic. For in modern manufacturing plants, good climate is considered good business. Brewers, canners, confectioners, printers—along with hundreds of others — are seeking perfect production climates for their plants. And are *getting* their perfect climates — with the help of Parks Engineers.

In hundreds of plants—both large and small—Parks Engineers have provided the Certified Climate that certifies profits. From their thirty years of thorough research and wide range of air-conditioning applications Parks Engineers are best qualified to answer your particular problems. Find out what Certified Climate can do for your plant. Have a Parks Engineer call. No obligation. Write.

PARKS

Certified Climate

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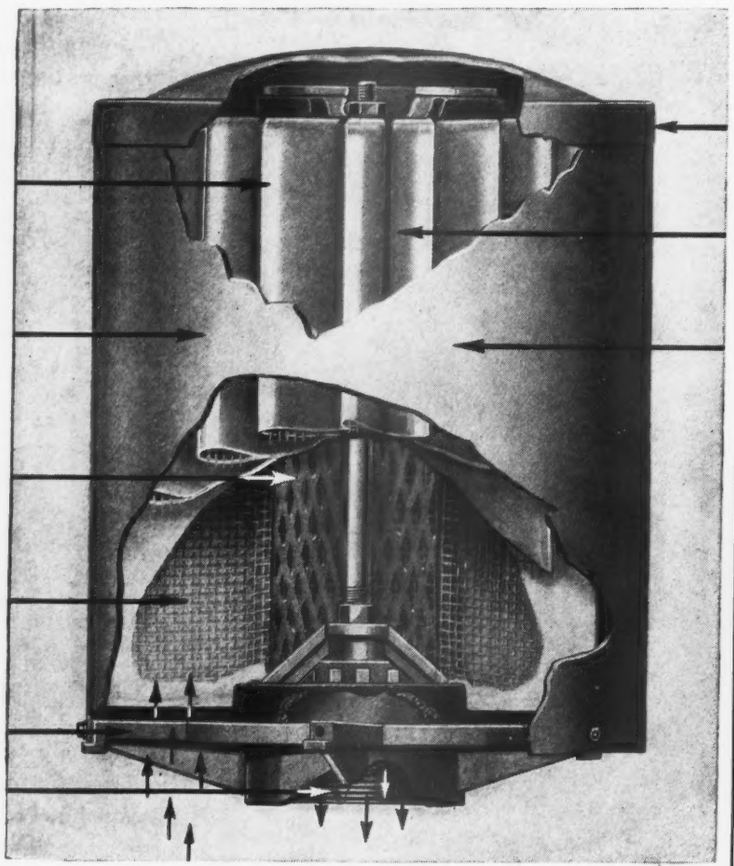
PARKS-CRAMER CO., FITCHBURG, MASS. . . . CHARLOTTE, N. C.

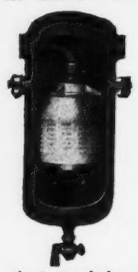
The finest AIR FILTER *ever made—*
PROTECTOMOTOR

MODEL "D"

for pulsating intake on Diesels, gas and gasoline engines, compressors, etc.



Model "CPH"
Air Line Filter



For air transmission line filtration to pneumatic hoists, air hammers, drills, riveting guns, paint sprayers, etc., etc. Contains both exclusive Protectomotor features.

Exclusive Features →

RADIAL FIN CONSTRUCTION

Resists pulsation better than any known form, having no broad, flat surfaces to vibrate. Permits large area of filtering medium to occupy a small space. This means low resistance to air flow, and long filter life. No other filter has the Radial Fin Construction.

FELTEX FILTERING MEDIUM

A positive dry filtration medium, exclusive in Protectomotors. Feltex in the Radial Fin Construction produces a long lasting, easily cleaned and highly efficient filter. No oil necessary. Clean, dry air is guaranteed.

ANY PROTECTOMOTOR FILTER INSTALLED FOR 30 DAY FREE TRIAL. WRITE FOR CATALOG TODAY.

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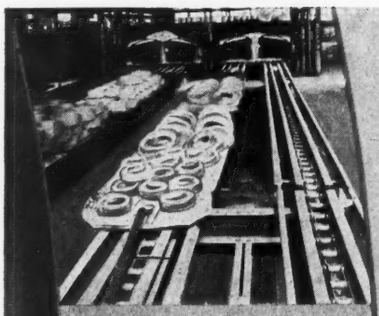
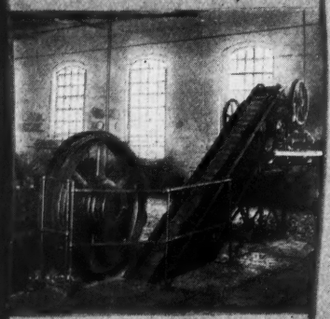
AIR FILTERS

MODELS FOR AIR CONDITIONING AND DUST RECOVERY ALSO MANUFACTURED BY STAYNEW.

STAYNEW FILTER CORP., 14 LEIGHTON AVE., ROCHESTER, N. Y.



G-W Oven Conveyors

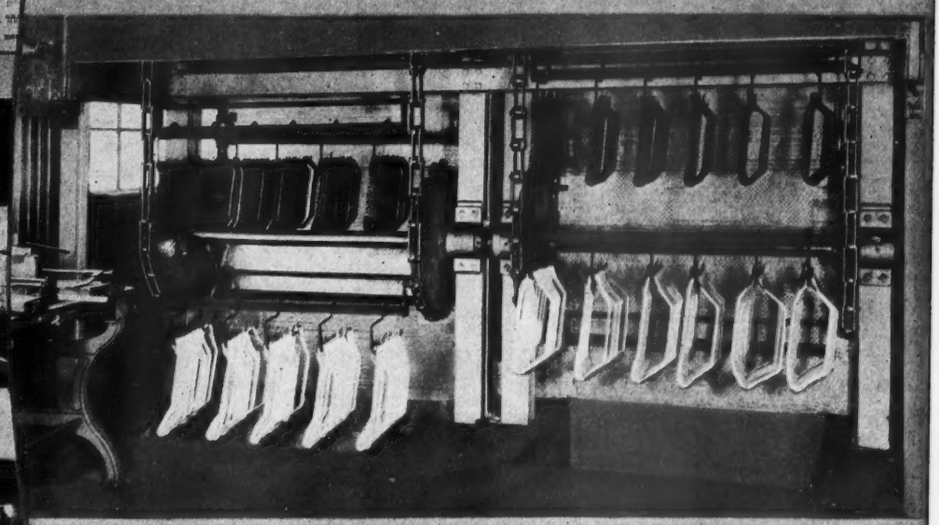


G-W Rivet Conveyor

G-W Tray Elevator

G-W Wood Slat Apron Conveyor

G-W Belt Conveyor



HANNIBAL'S ELEPHANTS WERE ULTRA-MODERN MATERIAL HANDLING EQUIPMENT

when he crossed the Alps with his armies in 218 B. C.

Though far from modern now, there are still lots of elephants—white elephants—in American factories where Gifford-Wood material handling equipment would speed production, save space, avoid congestion, reduce costs.

Whatever you regularly move in quantity from place to place, you will find Gifford-Wood can design and produce for you a most efficient and dependable material handling system.

G-W equipment for the mechanical handling of materials is applicable to practically every phase of industrial activity. It is used by many noted concerns for handling bulk raw materials during preparation, storage, reclaiming and shipping; at the plant for unloading, storing and handling; for packaged goods in packing, assembling, storage and transportation; for unloading, storing and reclaiming of coal and the removal of ashes. Many special handling systems involving peculiar or unusual conditions have been successfully solved by Gifford-Wood engineers. Why not consult them? No obligation will be imposed on you.

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Greater production at greatly reduced cost is accomplished by using Gifford-Wood conveyors for carrying coils through the process of applying insulating varnish at the Schenectady plant of the General Electric Co.

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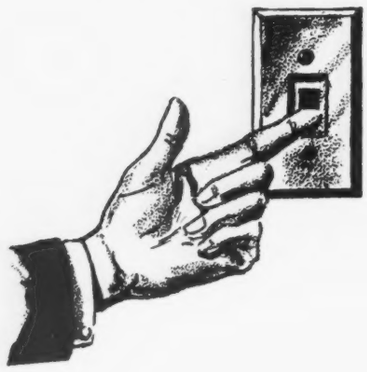
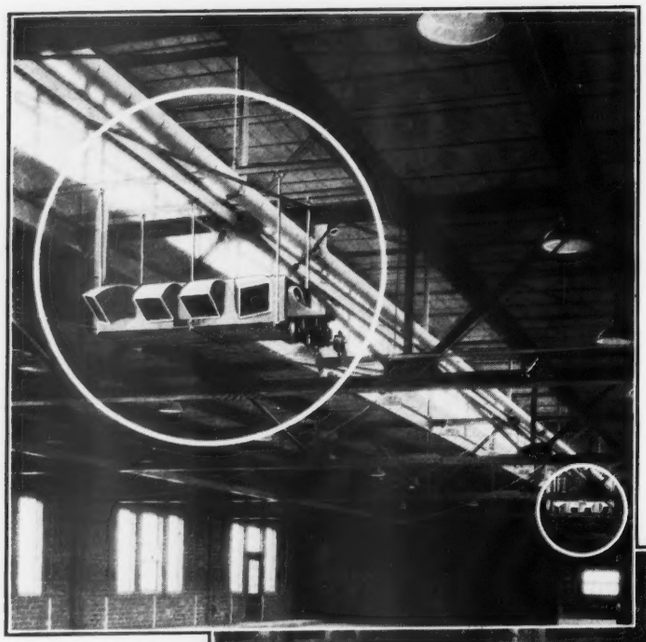
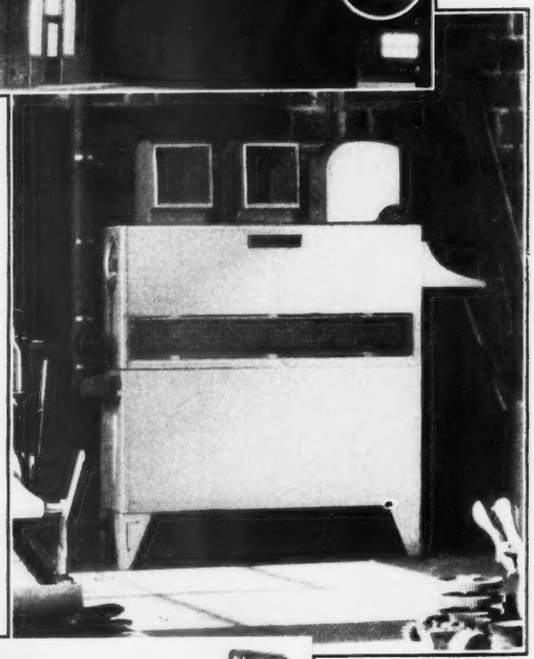
HEAT right where you want it at the flip of a switch





"Buffalo" Flat Suspended Lowboy Unit Heater. Excellent for large areas where floor space is at a premium.



"Buffalo" Highboy Floor Type. A large capacity Heater capable of distributing warm air in any direction.

"Buffalo" UNIT HEATERS

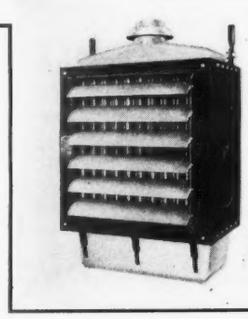
—offer you new heating efficiencies and economies that are as far ahead of the old methods as the V-12 is ahead of the old "one lunger."

Operating on low or high pressure steam, they are quickly and easily installed just where you want them. No long warming up periods—The large capacity quiet fans quickly distribute the warm air over the area to be heated. Heaters may be operated automatically or at the mere flip of a switch.

Sizes and types for every industrial need—space heating, special process work, wherever controlled heat is needed.

Write for valuable 32 page book on "Buffalo" Unit Heaters.

"Buffalo" Breezo-Fin Unit Heater. The most economical heater for smaller areas.



"Buffalo" Gas Unit Heaters — the ready solution to economical heating where no steam is available. Equipped with every safety device.

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Branch Engineering Offices in Principal Cities

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HERE'S SMOOTH CONTROL *without a break*

FOR ANY DEGREE OF WELDING HEAT OVER ITS ENTIRE RANGE...

There is no limit to the tones, overtones and undertones you can draw from a violin. There are no divisions, no frets—wherever you touch the string to the finger board, it responds. This same principle is used on the P&H-Hansen Smootharc Welding Generator. From top to bottom—over its entire welding range, wherever you move the current setting, the generator delivers the exact amount of current indicated. There is no limit to the number of current settings you can make with this micrometer control.

Once the amperage is selected, the open-circuit voltage is automatically regulated. There is no chance for the operator to blunder in selecting the proper open-circuit voltage.

SMOOTHARC WELDERS

Ask us to send you the new Smootharc Bulletin (W-10) which explains these outstanding features in detail. Write today.

NOW TRY THIS NEW WELDING ELECTRODE

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FOR FLAT, VERTICAL OR OVERHEAD WELDING ON MILD STEEL

Designed for DC welding on reverse polarity; gives you a stable arc with very little spatter loss. Produces fast, clean welds with no undercut; slag is removed with remarkable ease. Deposits metal with tensile strength from 65,000 to 70,000 lbs. per sq. in. Elongation of 25% in 2"—resistance to impact of 30 to 60 ft. lbs. (Izod). Sizes from 1/8" to 3/8". Test samples sent free on request.

SINGLE CURRENT CONTROL—A SMOOTHARC PATENT

The P&H-Hansen system of single current control is found exclusively on Smootharc welders. It is simple, foolproof. It takes the guesswork out of current settings, minimizes the human element, leaves nothing to chance to result in faulty welds. Whether you use bare or coated electrodes, you are always sure that the necessary high, open-circuit voltage is maintained at all times. For complete performance data, address the Harnischfeger Corporation.

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ARC WELDERS • EXCAVATORS • ELECTRIC CRANES P&H MOTORS • HOISTS • WELDING ELECTRODES

SALES CLERKS GET INTRODUCED TO THE FLAX GARDEN

(*LINUM USITATISSIMUM*)

LINEN is a term that is understood by the trade and the public to designate a yarn or fabric made wholly of the fibres of the flax plant (*linum usitatissimum*). Partly through ignorance and partly through design, some manufacturers and merchants have recently used the word linen in the selling of garments containing no flax fibre whatever.

The National Better Business Bureau circulated a special nation-wide bulletin exposing these practices and giving educational information for the benefit of manufacturers, wholesalers, retailers and their sales clerks.

Of course, there were originally a number of specific complaints concerning this linen question, involving not only cotton and rayon, but even silk. These individual cases were followed up and threshed out from the various angles involved, and with great success in establishing equitable practices all round. But the broadest results of the Bureau's activities, in this and other cases, are to be found in the *preventive effect* of the Bureau's bulletins, broadcast through trade and publication channels and through its affiliation with fifty-five local Bureaus from coast to coast.

• • •

The National Better Business Bureau is a non-profit organization, serving business and maintained by business. It serves as a clearing house for complaints against frauds and practices unworthy of American business. Its services are available to all—to non-members as well as members—but its only income is from members' contributions.

In relation to your own business, you may find much of value in an intensive use of the Bureau's consultative facilities *and accumulated experience. Write for special report for executives. There is no obligation.*

NATIONAL BETTER BUSINESS BUREAU, INC.

405 Lexington Avenue, New York City

Please send me a copy of "....."

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YOUR PLANT IS "DATED" BY THE FLOOR IT KEEPS

FLOORS

Like photographs had their

YOU PRESS THE BUTTON ERA

You pressed the button and the Camera did the rest, in the good old box camera days. But even today the modern candid camera would reveal many an old obsolete, money-wasting floor in today's industrial plant, otherwise the picture of progress—floors that candidly are rendering negative the plant's efforts toward economy and efficiency.

STAMP THE DATE 1937 ON YOUR PLANT WITH

CENTRAL *Rolled Steel* FLOOR PLATES

HERE IS FLOORING THAT MATCHES . . .

modern equipment efficiency

You are putting in new machines to step up efficienties, to cut operating costs, to meet increased financial demands. But if you are still operating on floors that are worn out, that splinter, chip, dust or absorb oil or grease—your efforts toward efficiency are handicapped.

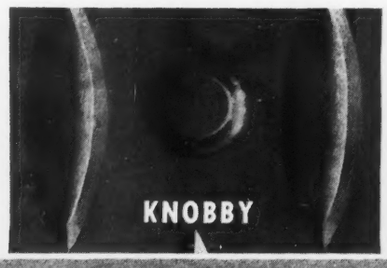
Install Central Rolled Steel Floor Plates now. They will long outlast the usefulness of your most modern machines—and render perfect trouble-free service all those years. These plates are designed to meet all specific conditions better than any other form of flooring in your plant. They make footholds safe—not slippery. They defy wear and tear. They do not absorb moisture. They are easily cleaned—quickly installed, almost overnight, at slight expense.

Made in types and weights not only for floors but for numerous other places in the plant—step treads, elevated platforms, "catwalks", balconies—wherever foothold must be secure and service permanent.

All the data you need is now ready—write for full information and if you wish, call upon us to submit information *on your plant* as to cost and speed of installation. Write us today.

1 ALL-WAY-GRIP — General purpose flooring, maximum non-skid qualities.

2 KNOBBY — Perfect foot support, recommended for heaviest traffic.



3 KNOBBYETTE — Lighter duty flooring for general use.

CENTRAL

IRON AND STEEL CO., HARRISBURG, PA.

Established 1853

Manufacturers of Sheared and Universal Plates—Forging Billets—Slabs
Blue Annealed Sheets—Flanged and Dished Heads—Steel Stampings—Rolled Steel Floor Plates

MAKE YOUR TABLE-TALK WIN YOU FURTHER INVITATIONS
DO YOU HAVE TO TALK ABOUT THE WEATHER?
DOES YOUR BOSS DRUM ON THE TABLE WHEN YOU TALK IN MEETINGS?
Make them say "You said it!"
HOW'S YOUR COME-BACK?
CAN YOU SAY IT WITH GRACE AS WELL AS TO GRACE?
DO YOUR BUSINESS ASSOCIATES THINK OF YOU AS A GOOD TALKER?
HAVE YOU A GOOD LINE?

How often do you gain heart-felt approval of what you say? How effective is your everyday conversation? Are people won over to you when you talk?

Because relations with people are so large a part of your daily life, in business and social activities, the ability to talk is your most important asset in keeping these relations smooth and in winning people over to your ideas. And the better you talk, the greater will be your success.

"I say without hesitation, this is the best book on conversation ever written." — ALBERT EDWARD WIGGAM

"Will help all who wish to be able to carry on an interesting conversation." —*Liberty*

Milton Wright's

THE ART OF CONVERSATION

And How to Apply Its Technique

Already in its fourth big printing—$2.50

How to acquire the ability to talk— *readily entertainingly convincingly*

Are people won over to you when you talk? They will be if you understand and apply the technique of conversation. This book is a brass-tack analysis of talk today—its principles—its techniques. It is a fascinating, practical discussion of simple exercises which will improve everyday conversation.

IF you would win an argument or win a wife, cultivate a friend or humble an enemy, get information or give it, ask a favor or deny one, land a job, sell a bill of goods, be elected to office—if you would accomplish anything, at work or at play, where you are in the presence of other human beings, then you must talk.

So that you may learn how to talk to the best advantage in any situation, Milton Wright has written this book. He shows you—not merely tells you, but *shows* you—how to start a conversation, how to keep it going, how to direct it the way you want it to go, how to make precisely the impression you want to make and get exactly the result you want. He analyzes repartee and shows you how to develop facility in using it. He takes actual conversations apart and shows you what makes them tick.

Mr. Wright's book is firmly grounded in psychology and is written in his easy-to-read style. You can't help setting yourself in the places of the people who do the talking, and when you've laid down the book, you want to go out and practice on your friends. It's a fascinating book—interesting, practical, and really helpful.

How would you work out these problems?

—How would you keep up the interest of a group for fifteen minutes in a topic selected by you? (See page 28)

—How would you discover a special interest of a person you have met for the first time? (See page 74)

—What steps would you take in a talk with just one other person to insure his wanting to talk with you again? (See page 111)

—How would you start, keep moving, and control the conversation at a dinner party of six? (See page 149)

TRY WRIGHT'S METHODS FREE

Check the list of conversational offenses on page 320; see how plainly Wright shows how to overcome these faults. You can make this test, read Wright's book, put his method right into practice, without obligation, simply by mailing the coupon. Take this practical way to see just what the book offers you. Mail the coupon today.

10 days' Examination

Send this Coupon

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.
Send me Wright's The Art of Conversation for 10 days' examination on approval. In 10 days I will send $2.50, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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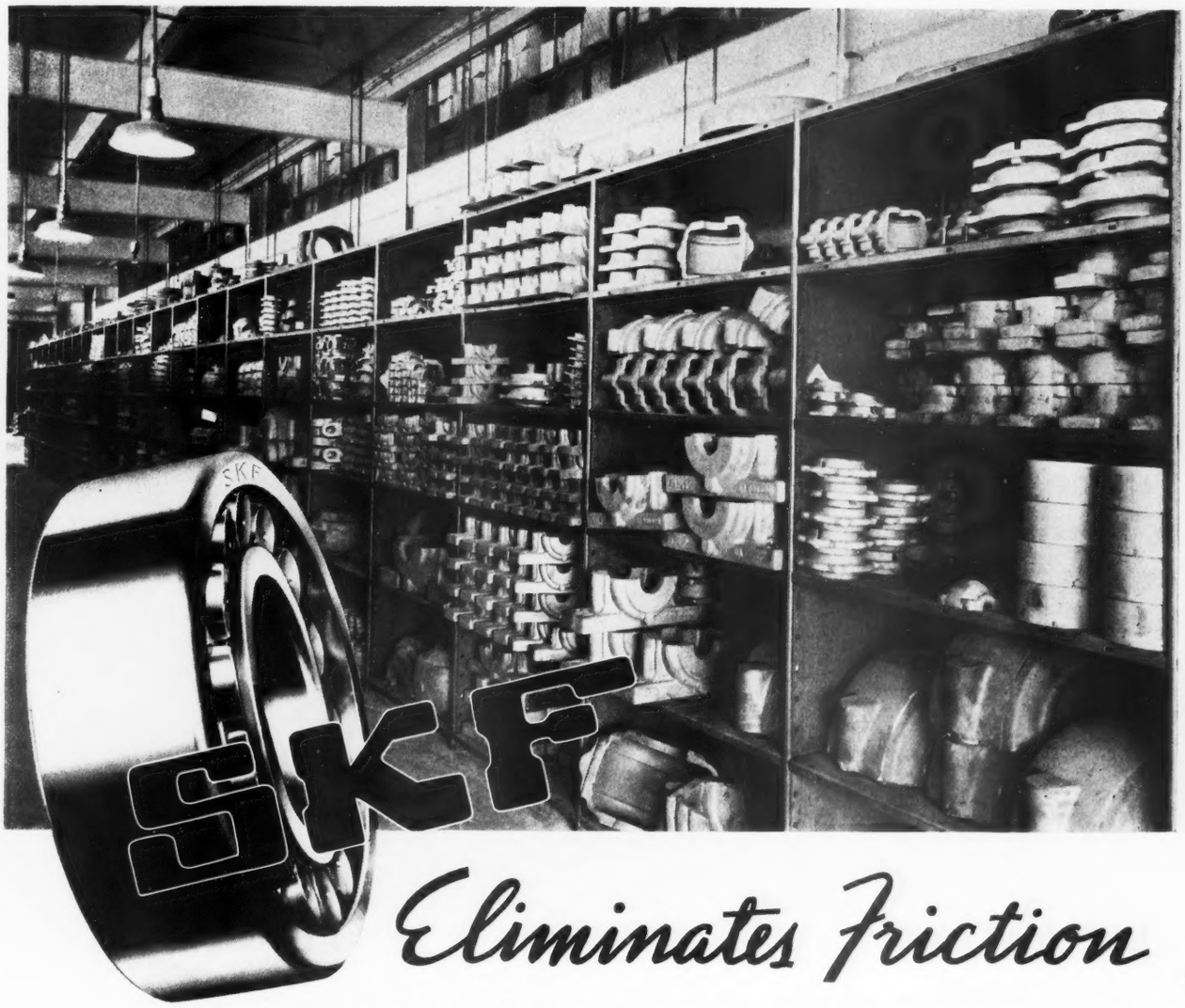

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IN PARTS HANDLING AND STORAGE

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Because it combines maximum utility, flexibility and salvage-ability, Lyon Steel Shelving is a lasting asset. It permits quick, low-cost rearrangement and additions at any time . . . is not affected by dampness . . . resists fire . . . will not warp, swell, shrink or split. Mail coupon for full details on industry-proved time and money-saving advantages of Lyon Steel Shelving.

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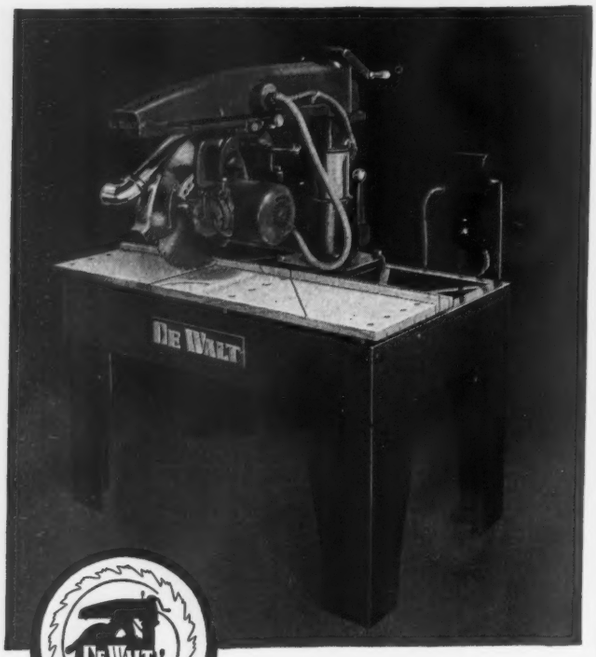
"GE" DeWALT

. . the latest development in WOODWORKERS



It's new . . . this "GE" Type DeWalt ! More flexible than ever in the variety of cuts it makes . . . the many things it can do better, quicker, *more accurately.* Thousands of plants that have operated De Walt Woodworkers will replace obsolete models and various single-purpose machines with this modern engineering triumph.

Almost every industrial plant has a steady job for this "GE" Type De Walt. On the production line, its sturdiness and speed of adjustment fit perfectly into manufacturing operations. In maintenance departments, pattern shops and shipping rooms, it quickly pays for itself in hundreds of ways.

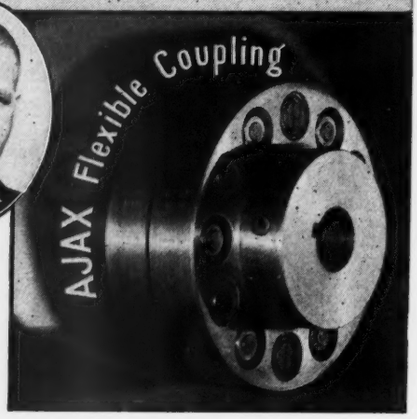
Do This . . . Write or wire immediately and a convenient date for demonstration right in your plant will be arranged. We'll show you scores of case records to prove its economies. Or, if you prefer, ask for descriptive folder with specifications. No obligation.

Address
DE WALT PRODUCTS CORPORATION
604 Fountain Ave., Lancaster, Pa.

It talks through its teeth

In New York City

W. RICHARD WITTE IS KNOWN AS THE "AJAX COUPLING MAN"



Correct selection and application of flexible couplings are important because of the costly machines they connect. Plant men throughout the New York territory are depending on the experience and recommendation of W. Richard Witte. He has built a reputation on the performance of Ajax Flexible Couplings.

Positive Drive . . . Resilient Flexibility . . . Protection Against Misalignment . . . Free End Float . . . Long Life Dependability . . . you get them ALL with Ajax Flexible Couplings. Call in the Ajax Man or write for Ajax Data Book.

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FOR GREATER *Protection Economy Service*

USE NITROSE

. . . the corrosion resisting covering that requires no cleaning, no primer, no second coat.

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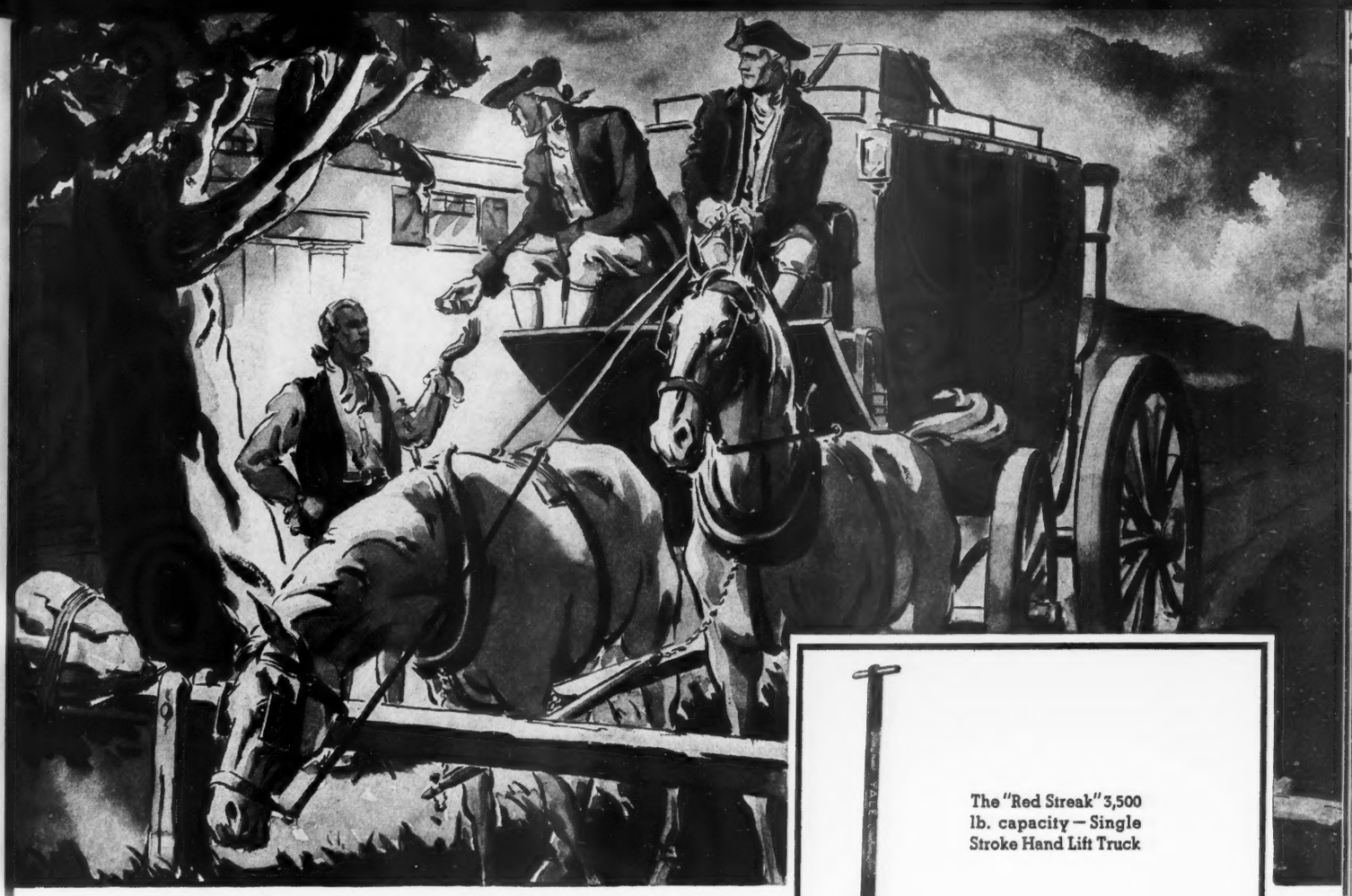
NITROSE
The Liquid Armor that spreads like paint



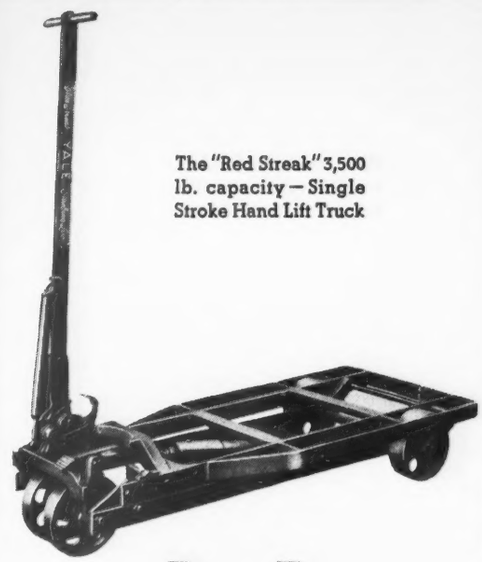
BEWARE THE *Toll of Tradition* ..GO MODERN WITH YALE HAND LIFT TRUCKS

It's not so long ago that lumbering stagecoaches clattered over the highways, paying tribute at every toll gate. The most efficient mode of travel then known—*NOW* relics of a picturesque past . . . Because time works changes that make the efficiency of yesterday ineffectual today.

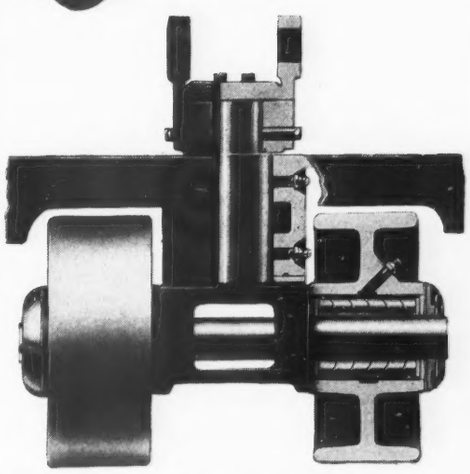
That's the price of progress—the reason that materials handling methods which may have brought results for years, fall down when compared to modern systems. One simply has to keep up with the times or pay the Toll of Tradition—excess overhead that bites deeply into profits.

Perhaps therein lies the answer to YOUR cost problem. If so, you can solve it with Yale.

The *YALE HAND LIFT TRUCK AND SKID PLATFORM SYSTEM* is the most modern in its field. It combines the four features of Safety—Speed—Efficiency—and Economy to the Nth degree . . . Brings you the mechanical features of tomorrow—TODAY.



The "Red Streak" 3,500 lb. capacity — Single Stroke Hand Lift Truck



RUGGED FRONT END CONSTRUCTION — Front wheels equipped with over-capacity roller bearings mounted on axle of high carbon chrome manganese steel. Axle key eliminates wear—hardened steel thrust washers on either side of wheels assure maximum life.

LET OUR REPRESENTATIVE TELL YOU MORE ABOUT THE YALE LINE

TRADE YALE MARK

THE YALE & TOWNE MANUFACTURING COMPANY,
PHILADELPHIA DIVISION, PHILADELPHIA, PA.
IN CANADA: ST. CATHARINES, ONT.

Compare

THIS ECONOMY

● Final performance proves the economy of any bearing bronze. Long, trouble-free operation—uninterrupted bearing life are possible only with quality bronze. Quality in Bronze is a matter of selecting the CORRECT alloy.

S.A.E. 64—Copper 80%; Tin 10%; Lead 10%—has definitely remained the favorite alloy of maintenance men and engineers for more than 60 years. It combines, in the correct proportion, the necessary elements to insure genuine bearing performance.

Johnson UNIVERSAL Bronze gives you this feature—plus additional economies. Complete machining eliminates all undersurface defects—assures concentricity and saves 25% in weight.

Now you order bearing bronze according to the FINISHED size. Only a 1/64" cut is necessary to bring to size.

Anyway you compare it, Johnson UNIVERSAL Bronze is the most economical, most satisfactory bearing bronze available. Try it on your next application. Convince yourself that it represents the best buy in Bar Bronze.

JOHNSON BRONZE
512 S. MILL STREET · NEW CASTLE, PA.
Sleeve BEARING HEADQUARTERS

SAVE MONEY . . . SAVE SPACE
SAVE EMPLOYEES' TIME WITH THE

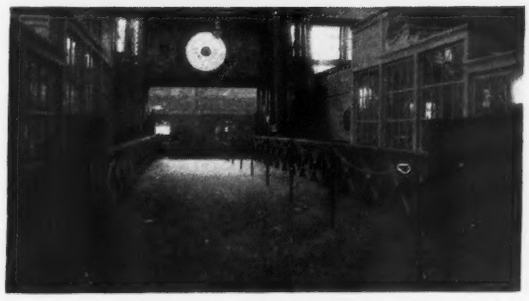
new **Janitrol**
GAS-FIRED
UNIT HEATERS

1. **GREATER EFFICIENCY** . . . no work or worry with the exclusive new Janitrol combination switch and thermostat. No hot spots. No cold spots. Even temperatures protect employees' health.
2. **INCREASED PROTECTION** . . . no possibility of overheating with Janitrol's exclusive automatic safeguard.
3. **NEW QUIET IN OPERATION** . . . assured by Janitrol exclusive sonic silencers, non-resonant alloy in heat exchanger, new-type fan.
4. **HANDSOME APPEARANCE** . . . new design . . . attractive finish . . . all 14 models uniform.

● Suspended from the ceiling . . . taking up no floor space . . . requiring no central heating installation . . . Janitrol gas-fired Unit Heaters save money, time and space in thousands of commercial and industrial establishments. Completely automatic . . . Easy to install . . . Economical to operate . . . And now offering outstanding new improvements. See your local gas company. Write for interesting free booklet, "Profitable Heat."

Janitrol GAS-FIRED
UNIT HEATERS
SURFACE COMBUSTION CORPORATION
TOLEDO, OHIO

"so they MASTIPAVED the floor!"



(Few factories have as TOUGH a floor problem as this one!)

Built on creosote-soaked piles . . . floored with uneven planking . . . muttering, "Shiver my timbers!" every few minutes of the day and night as heavy ferry boats warp into its slips . . . continuously pounded by heavy trains . . . this terminal offered a *real* floor problem. Ten million people a year shuffle and scuff through it from boat to train, from train to boat . . . dropping many a cigarette and cigar stub that must be kept away from the inflammable understructure.

Every possible type of floor covering was tested over a period of many months . . . and *Mastipave* won in a walk! That was four years ago; today the floor is still as good as new! Water-proof, rot-proof, vermin-proof . . . self-healing, if cut or scratched . . . tough, yet resilient unbelievably wear-out-proof, it was the *one* ideal material for this floor job . . . just as it has proven to be the best for many another floor in practically *all* types of industry!

If you would like to know more about

THE LOW-COST, LONG-LIFE FLOOR COVERING

MASTIPAVE

Send the Coupon!

724

Send this Coupon to

THE PARAFFINE COMPANIES, INC.

Dept. 25-FM, San Francisco, Calif. (or) Somerville, N. J.

☐ Send "Case Histories" book ☐ Have representative call

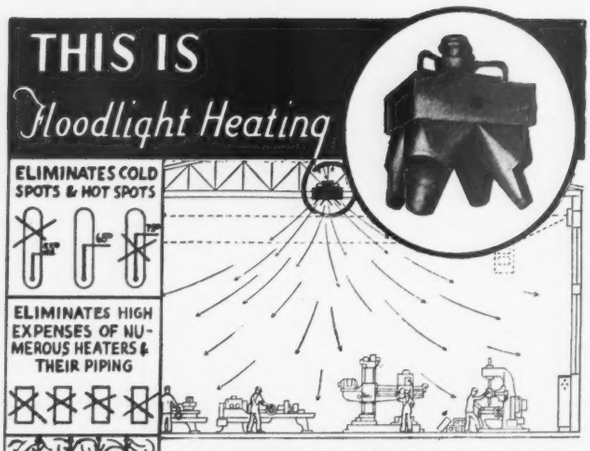
☐ Send name of nearest contractor

Name..... *Title*.....

Company.....

Address.....

THIS IS *Floodlight Heating*


ELIMINATES COLD SPOTS & HOT SPOTS
ELIMINATES HIGH EXPENSES OF NUMEROUS HEATERS & THEIR PIPING
ELIMINATES LARGE HEAT LOSS AT THE ROOF
ELIMINATES WASTE OF SPACE FOR HEATERS ON FLOOR OR WALLS

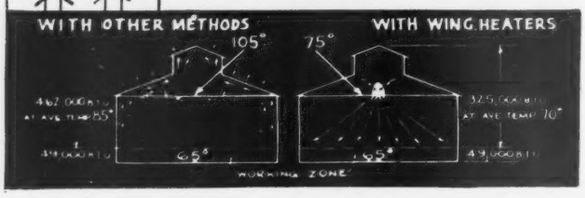
The most MODERN, ECONOMICAL METHOD OF HEATING A BUILDING . . .

WING *Featherweight* UNIT HEATERS

distribute the heat evenly to the working area below.

Send for interesting Bulletin.

L. J. WING MFG. CO.
162 W. 14th St., New York, N. Y.
and everywhere



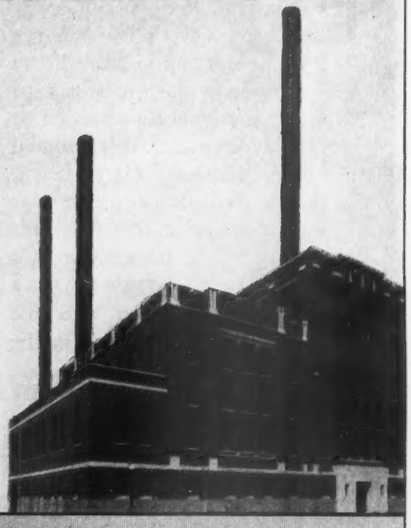
TO CUT YOUR POWER COSTS··

Carey INVEST IN HEAT INSULATIONS

Carey Insulation is the logical starting point for higher efficiency in power plant modernization. Normally, it effects fuel savings that make it an exceptional investment, frequently repaying its entire cost in a year or less.

Leading utilities, whose one product is POWER which must be produced at minimum cost, recognize this fact and are among the nation's largest users of Carey Insulations.

Profit by Carey's 50 years insulation experience. Call the nearest Carey Office for a survey of your plant to determine the possibilities for substantially reducing your power costs.



ASPHALT — ASBESTOS — MAGNESIA

Roofing . . . Flooring . . . Insulations . . . Roof Coatings and Cements
Waterproofing Materials . . . Expansion Joint . . . Asbestos Paper and Millboard

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

BAGS, BARRELS, BOXES, BALES, ROLLS *or what have you?*

MOVE anything around all day—at the end of the day you have no more value—but *much* added cost. Adopt a Colson Lift Jack System and you spot loads where you want them—when you want them—in the quantity you want them. With this system *dead* storage space becomes *live* load—quickly and economically.

Two simple, long-enduring units do the trick:

1. A platform or live skid with wheels on one end and legs on the other.
2. A twin-wheeled jack that engages the front end of the platform and converts it into a sturdy, easy-to-roll truck.

Loads as much as 3,000 to 4,000 pounds per truck are then readily transported—every load is instantly mobile.

INEXPENSIVE, TOO

Another remarkable thing about the Colson Lift Jack System is its low cost. As little as $150 will buy a Colson Lift Jack and several platforms—no other equipment is needed. Write for booklet "Colson Materials Handling System" that gives complete information.

THE COLSON CORPORATION
3707 Cedar Street • Elyria, Ohio

Colson

LIFT JACK SYSTEM

35 to 50 bags of sugar—100 pounds each—in and out of storage with minimum handling.

Doc. *Steelstrap* PREVENTS A HOLDUP

PROFITS ARE ROBBED BY EXCESSIVE SHIPPING COSTS

● Are part of the profits of your company being stolen by the common sneak thief *Excessive Shipping Costs?* If they are, you can eliminate these unnecessary losses by consulting Doc. Steelstrap. He has helped hundreds of concerns rid themselves of this unseen marauder by prescribing Acme Streelstrap.

The application of ACME Steelstrap to your carton, box, bundle or crate will afford protection against uncalled-for shipping and handling expenses. It assures important savings by enabling the reduction of materials, weight, labor and time. And the contents are more effectively safeguarded.

Put Doc. Steelstrap on the trail of your shipping dollars that are disappearing needlessly. He may furnish clues which will enable you to effect a 10% to 50% reduction in your shipping costs. "My Second Strap-Book" shows how practically every type of product can be shipped more economically when Acme Steelstrap is used. Mail the coupon for your free copy.

ACME STEEL COMPANY
GENERAL OFFICES:
2831 Archer Avenue, Chicago, Ill.

Branches and Sales Offices in Principal Cities

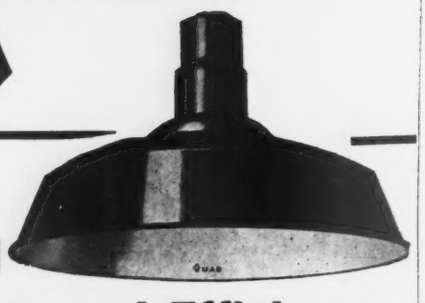
ACME STEEL COMPANY, 2831 Archer Ave., Chicago, Ill.
Gentlemen:
☐ Send me particulars about a free diagnosis for better, more economical shipment of our product.
☐ Mail a copy of the illustrated booklet "My Second Strap-Book."

Name _____

Address _____

City _____ *State* _____

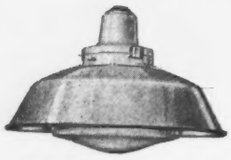
QUAD REFLECTORS



Give You The Safety and Efficiency of a Higher "SEE" Level

Higher intensity, even light distribution and no shadows are as requisite in the modern plant as the planned production schedules which Quad Reflectors help maintain all over the country.

HELPFUL DATA ON EFFECTIVE LIGHTING



QUAD Glassteel Diffuser. Easy Maintenance Safety Type—speeds up production and decreases spoilage.

QUAD Duplex Dome Reflector illuminates upper walls and ceilings with diffused light and delivers direct light downward.

New Quad pocket sized Data Book Catalog contains invaluable information on effective and economical lighting. Write for copy today. Gives recommended foot candle intensities, mounting and spacing data, also lamp size formulas and a lot of other new and helpful facts.

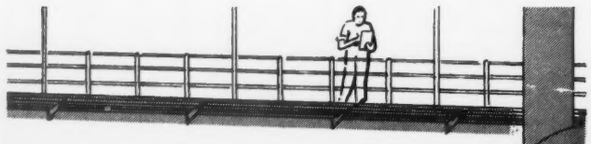
There's a Quad reflector suitable for every lighting need:—Dome Reflectors of every size and type, Bowl, Cone and Angle Reflectors, Vapor Proof, Ruby Lens and Post Top Reflectors, also Reflectors for Mercury Vapor Lamps, Multiple Mounting Flood Lights, Bracketlites, Ceiling and Commercial Units, Swivel Stem Pendants and a full line of reflector fittings.

The Quad Data Book Catalog pocket size is invaluable. Write today for Free copy.

QUADRANGLE MANUFACTURING CO.

Members of RLM Standards Institute

26 South Peoria Street Chicago, Illinois



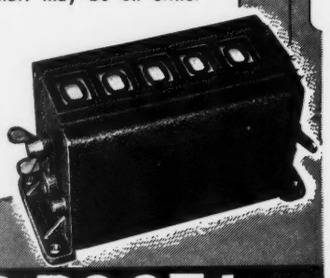
EASY TO READ FROM A DISTANCE

Veeder-Root's Large-Figure Counters

In installations that are out of the way, hard to get at, or entirely inaccessible for close-range reading, this counter is a definite saver of time and trouble. It can be easily read from any distance up to 50 feet.

Figures are black on white, ¾" high, ⅝" wide. Any number of figure wheels from 3 to 6, as desired. Counter itself is 8" long, 4" high, 3" wide. Made in 3 types: ratchet counter with stops, revolution counter, direct drive counter. Shaft may be on either right or left side. Resetting feature is optional. No lubrication is required.

These Large-Figure Counters have a wide range of usefulness. Write for prices.

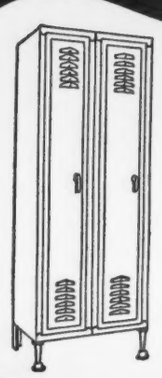


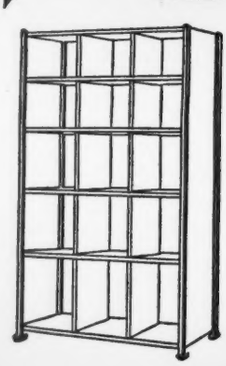
VEEDER-ROOT Inc.

HARTFORD, CONNECTICUT, U. S. A.

MEDART

STEEL LOCKERS *and* STEEL SHELVING





There's a difference!

Write for Catalogs

FRED MEDART MANUFACTURING CO.

3544 DE KALB ST. ST. LOUIS, MO.

Sales Engineers in All Principal Cities—Consult Your Telephone Directory

THE ENGINEER FROM INSULATION HEADQUARTERS SAYS:

"MAKE INSULATION MEET THE TEST OF A GOOD INVESTMENT"

"PRIMARILY an investment, insulation must be bought on the same basis. Price alone cannot determine its value. Full and continued dividends . . . in the form of cash returns on fuel savings . . . are the important factors."

These words, coming from Insulation Headquarters, sum up 75 years of constant research and the practical field service of J-M Engineers working with insulations of greatest efficiency and durability.

Choosing insulations on their investment worth is applying a basic buying principle that has guided hundreds of industrial plants throughout the country to maximum returns in fuel savings.

This principle involves making sure the insulation is right in kind, amount and application. For, like stocks and bonds, all insulations do not pay the same dividends. To guarantee maximum returns, an insulation must be designed specifically for the job in question.

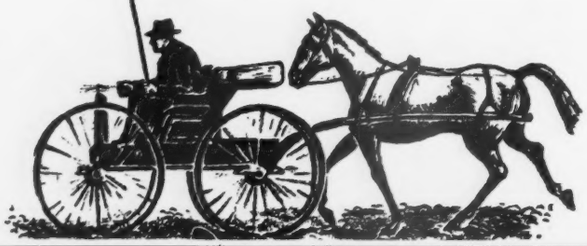
Johns-Manville has developed a *complete line* of insulations to meet the operating needs of every type of heated or refrigerated equipment. Hence, for each individual job, we are in a position to recommend and furnish the particular insulation designed to assure the largest cash returns in fuel savings over the longest period of time. Johns-Manville, 22 E. 40th St., N. Y. C.

Johns-Manville **INDUSTRIAL INSULATIONS**

An insulating material for every temperature . . . for every service condition

Putting the Cart Before the Horse

IS Ridiculous



but no more so than to store valuable merchandise and install expensive equipment when your buildings have "QUESTIONABLE ROOFS"

TO AVOID UNNECESSARY LOSSES *ROOFS SHOULD COME FIRST* . . . . . .

The most practical and economical means of securing this protection is with

STONHARD
PLASTIC ROOF RESURFACER

No need for messy heaters or ripping off old roofs. Apply it as it comes in the drum. Bonds permanently to any wet or dry roof. Send for details of TRIAL OFFER today.

STONHARD COMPANY

806 TERMINAL COMMERCE BLDG. PHILADELPHIA, PENNSYLVANIA

young GIVES HEATING DIVIDENDS

HEATING & COOLING EQUIPMENT

Offers a complete line of heating and cooling equipment which permits the architect or engineer to select a unit best fitted to meet his most exacting specifications.

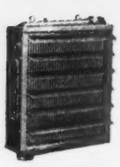
Unit heaters — for ceiling suspension available in 24 sizes and capacities from 18,000 BTUs to 658,000 BTUs per hour.

Floor type unit heaters — ranging in capacities from 120,000 BTU to 800,000 BTU per hour.

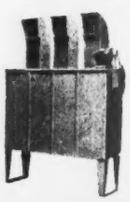
Commercial Heat Transfer Surfaces — in widths from 6" to 30", and 11" to 65" in length made with one or two rows of tubes deep.

Blast Units — encased for direct connection in air ducts, to be used in heating or cooling systems.

Offices in all Principal Cities



Suspension Type Unit Heaters

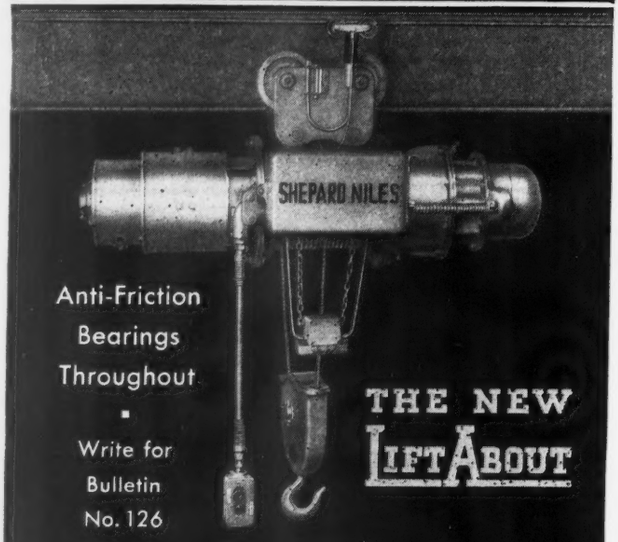


Floor Type Unit Heaters

Heating—Cooling Surfaces

YOUNG RADIATOR COMPANY
RACINE, WISCONSIN

The Modern Electric Hoist



Anti-Friction Bearings Throughout

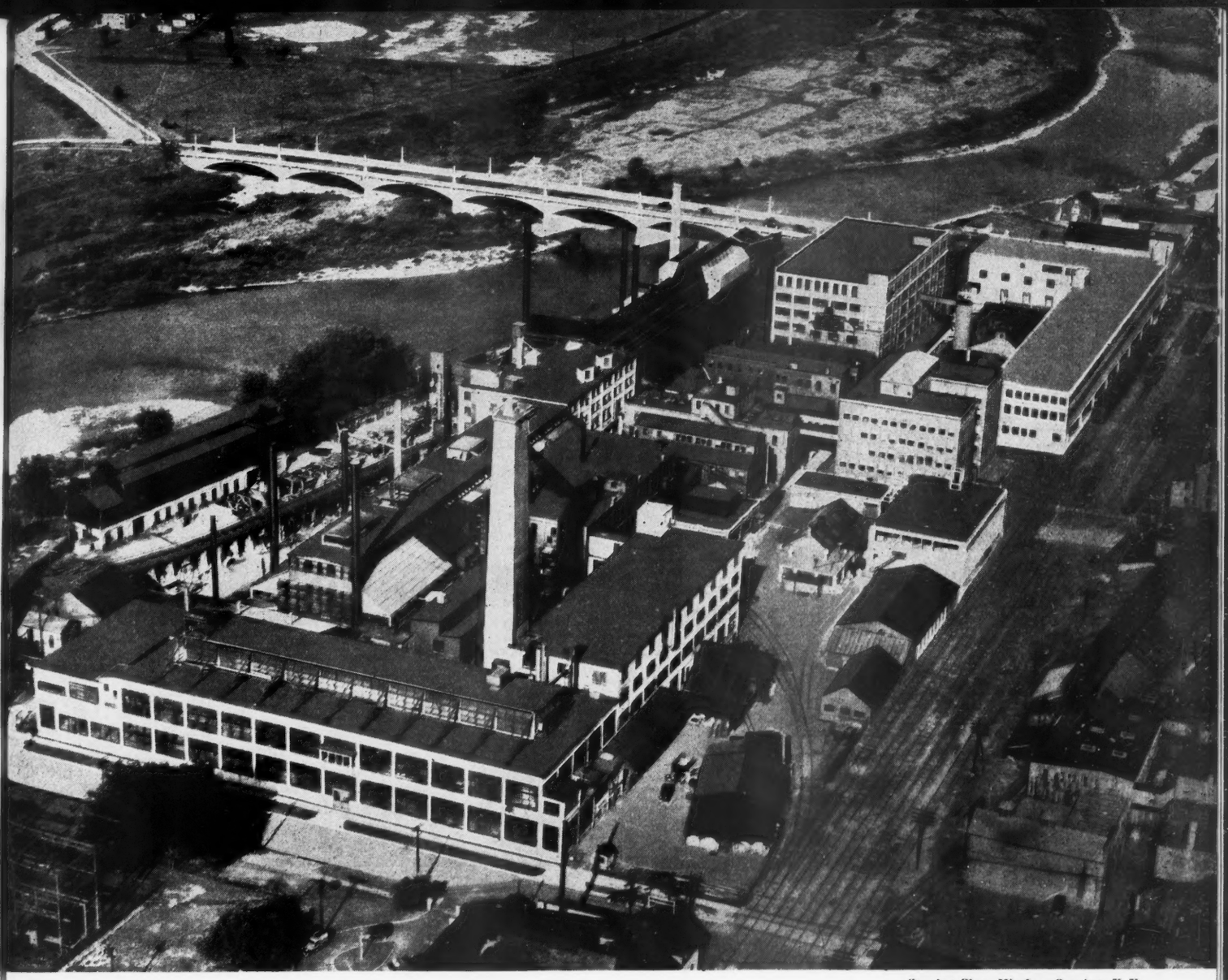
Write for Bulletin No. 126

THE NEW LIFTABOUT

SHEPARD NILES CRANE & HOIST CORP.

364 SCHUYLER AVENUE, MONTOUR FALLS, N. Y.

A COMPLETE LINE OF CRANES AND HOISTS



Corning Glass Works—Corning, N. Y.

The Owners of this great plant have given us eleven Repeat Order Contracts

FACTORY MANAGERS who have tried the older methods of buying factories, or additions, are urged to try our newer way, which is time tested by twenty years of Repeat Orders.

We design, build and often equip factories, complete with all machinery, and ready to run. So far this year we have had thirty-one Repeat Order Contracts totaling $7,919,731.30.

Our work is done by one organization, with one responsibility, one price and one profit.

Price, delivery date, quality of materials, and workmanship, are all guaranteed. If you are expecting to build now, or next year, you should get our proposal, which we will prepare quickly, cheerfully, and without cost or obligation to you.

The H.K. Ferguson Co.

ENGINEERS AND BUILDERS

CLEVELAND, OHIO • HANNA BUILDING • PHONE CHERRY 5870 • NEW YORK CITY • 25 WEST 43rd STREET • PHONE BRYANT 9-7257
SAN FRANCISCO • 58 MAIN STREET • EXBROOK 5059 • TORONTO, CANADA • 1221 BAY STREET • KINGSDALE 3646 • MEXICO CITY • MEXICO

Engineering Features
That Have Won National Preference
ILG UNIT HEATERS

FULLY ENCLOSED ILG SELF-COOLED MOTOR •

GUARANTEED AS A COMPLETE UNIT •

CERTIFIED I. U. H. A. RATINGS •

QUIET AIR MOVEMENT •

UNIQUE COPPER COIL CONSTRUCTION •

67 CAPACITIES AND SIZES •

One RESPONSIBILITY
ILG-BUILT *from Motor to Coil*

When you choose the Ilg Unit Heater you have the satisfaction of knowing that the manufacturer who sells it, designs and makes every vital part — motor, coil, and all. There's no division of responsibility — the Ilg guarantee is the manufacturer's guarantee of the complete unit.

Built as a highly specialized product since 1917, the Ilg Unit Heater is the only one that's powered by the Ilg self-cooled motor. Performance is a matter of record — one out of every three sold represents a repeat order. We invite you to send us a memo of any specific information desired.

ILG ELECTRIC VENTILATING CO.
2865 NORTH CRAWFORD AVENUE, CHICAGO, ILLINOIS

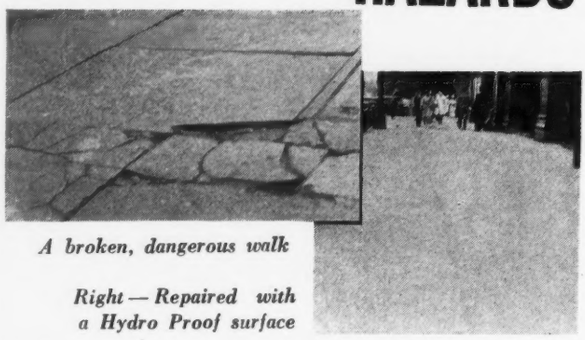
ILG
VENTILATION
and Air Conditioning

MEMO — Send me specific Ilg Unit Heater information as follows:

Name _____

Full Address _____

BROKEN WALKS and FLOORS ARE HAZARDS



A broken, dangerous walk

Right — Repaired with a Hydro Proof surface

In factories and warehouses, broken floors retard production and material handling. They cause damage to trucks and finished products. They disturb workmen and cause confusion.

Repair broken floors and walks with Hydro Proof and notice the increase in production and decrease in damaged material. Hydro Proof floors being dry and easy on the feet reduce employee fatigue and foot troubles.

Hydro Proof is waterproof, fire and acid resisting. Easily laid without special preparation.

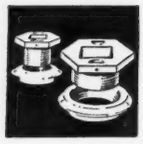
Order a trial drum now — don't delay.

THE ASPHALT PRODUCTS CO.
INCORPORATED
SYRACUSE Eastwood Station NEW YORK

SPRING WASHERS

Spring washers and lock washers of every type and size, including the well-known Hipower and Kantlink types. There are thousands of more places where spring washers would improve the value of any product where bolts, nuts, cap or machine screws are used.

STEEL BARREL CLOSURES



Forged and machined fittings for steel barrels, drums, tanks and metal packages, including plugs, rings and flanges. Very rugged for use in transportation of alcohol, turpentine, oils and other expensive liquids.

STEEL ROD ENDS

Drop forgings including steel rod ends of the adjustable yoke, plain yoke, and eye types. These articles in standard sizes and threads afford tremendous savings over special designs.

CONTAINER HANDLES

Forged steel handles for heavy containers—can be rigidly welded, riveted or attached by a strap to lie flat when not in use. Rugged and most satisfactory for hard usage.

RETAINING RINGS

Spring retaining rings of special heat-treated spring steel are carried in many stock sizes—both open and closed types. Use of a spring retaining ring is an excellent manner of creating a shoulder on a shaft.

RHEOSTATS—RESISTORS—LOAD BOXES AND SPECIAL APPARATUS

Our electrical division—Hardwick, Hindle, Inc.—makes as fine electrical resistance products, fixed and variable, as can be devised.

Other products include windows for buses and railway cars, railway car window curtains, curtain rollers and fixtures, sash locks and lifts.

THE NATIONAL LOCK WASHER COMPANY
NEWARK, N. J.—EXPORT DIV., 15 E. 26 ST., N. Y. C.

CAGED . . . and forgotten!

One Double VIM TRED Belt

(Condensed from a Houghton Engineer's Report)

It was a hefty load - - - 10 Cleveland Automatics - - - at one of the largest ball-bearing manufacturers in the world. And an 18″ Double Belt (not a VIM) kept slipping off. You couldn't blame engineers for saying:

"Get a new belt four inches wider!"

But the Houghton Engineer had a better idea. "With a pivoted motor base, an 18″ Double VIM TRED Leather Belt will pull that load perfectly," he said. "We'll guarantee the installation for 1 year - - - or no sale."

He got the order on that basis, and told us recently:

"We made that installation over 3 years ago. The 18″ VIM TRED has never failed. Production increased, of course. But - - - confound it - - - I wasn't optimistic enough!

"I find they've added 4 more Cleveland Automatics - - and the 18″ VIM TRED pulls the whole combined load without any trouble at all.

"And, get this - - - when I wanted to know how the drive was working, they couldn't remember it at first . . .

"You see, it has worked so well with VIM TRED that they just put a cage around it and forgot it!"

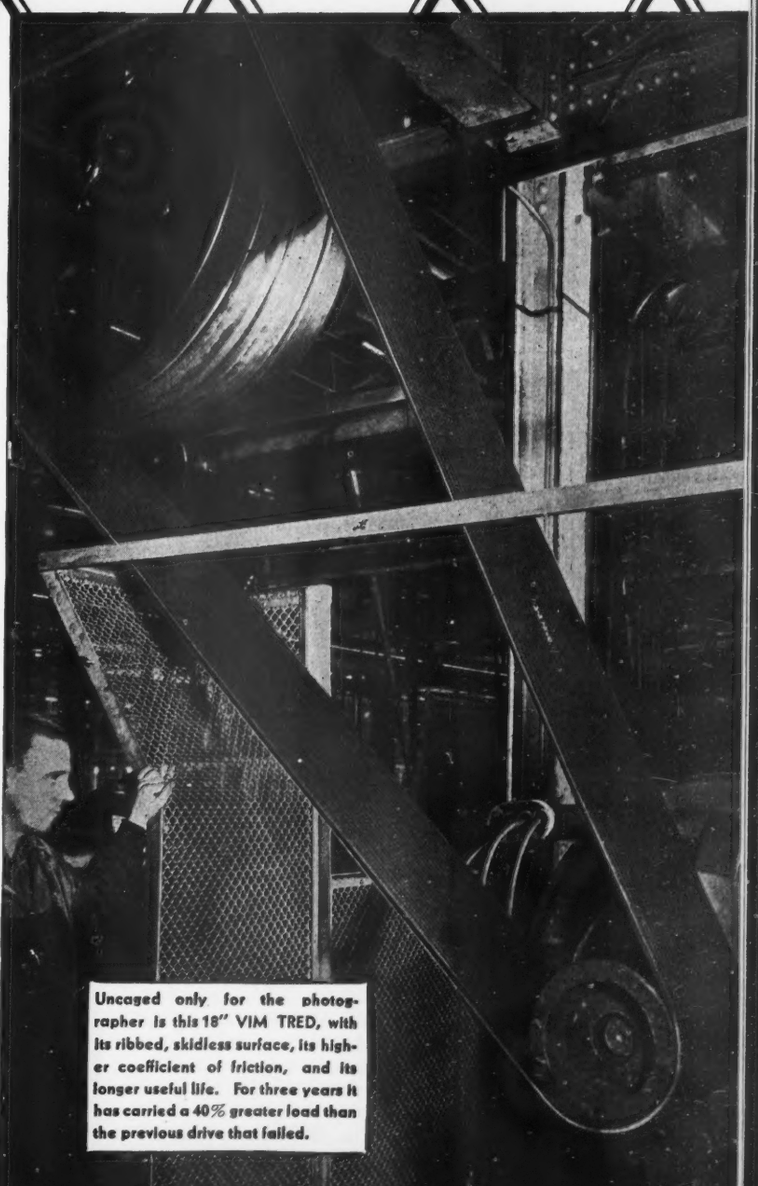
●

You can't beat the combination of proper engineering and VIM TRED LEATHER BELTS. Satisfactory, economical power transmission results therefrom.*

E. F. HOUGHTON & CO.

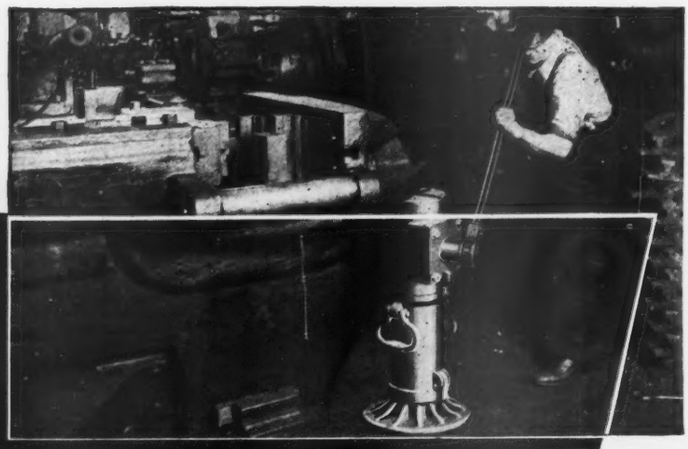
Chicago - PHILADELPHIA - Detroit

**And while you're thinking about belts, write for the Booklet, "How to Belt Your Drives for More Profit." It's free and it's helpful.*



Uncaged only for the photographer is this 18″ VIM TRED, with its ribbed, skidless surface, its higher coefficient of friction, and its longer useful life. For three years it has carried a 40% greater load than the previous drive that failed.

VIM TRED LEATHER BELTING



DUFF-NORTON Jacks

MAKE THE TOUGHEST LIFTING JOBS EASIER!

In mill or shop, where time is valuable and safety is paramount, you will find the husky, trusty Duff-Norton Jack always ready to serve without delay . . . designed for the roughest, toughest lifting service with plenty of power, strength and durability to spare . . . the line of jacks that are backed by years of outstanding performance throughout the industrial world.

The Duff-Norton Jack line is 100 per cent complete including smooth-running, ball-bearing, heavy duty screw jacks for all lifts from one to one hundred tons or more—also the famous Duff-Norton line of Genuine Barrett Ratchet Jacks.

Your local Mill and Mine Supply Dealer will be glad to supply your needs. Ask him about the Duff-Norton Line.

Duff-Norton Ball-Bearing General Purpose Jack Type C-35 in 15 to 35 tons capacity.

Duff-Norton Low Height Screw Jack No. 5017 with foot lift for very low loads.

Duff-Norton Automatic Lowering Jacks with the world renowned genuine Barrett mechanism.

THE DUFF-NORTON MANUFACTURING CO.
"The House That Jacks Built"
PITTSBURGH, PA.

WIRE

Round—Flat—Half Round
Straightened and Cut
Shape Wire

HIGH CARBON SPRING
OIL TEMPERED — LOW CARBON
BASIC OR BESSEMER
WELDING WIRE RODS AND COILS

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Sizes ½" to No. 40 WM Gauge (.007)—All Finishes

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Wire for Practically All Purposes and Requirements also SCREEN WIRE CLOTH

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Highest Quality and Service Guaranteed

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Established 31 Years

"SENECA" WIRE

The Seneca Wire & Mfg. Company
Fostoria, Ohio

Representatives and Warehouses in practically all principal cities

STOP CORROSIVE WEAR WITH PYROIL

CUTS OPERATION COSTS

Corrosion cannot attack frictionized metal parts where Pyroil is used. Serious wear is stopped or offset. Costly shut downs and repairs avoided. Operation speeded, maintenance costs reduced. Pyroil reduces friction and temperatures. Often completely solves an otherwise insurmountable lubrication problem. Sold, used, the world over.

FREE LABORATORY COUNSEL

Write, telling us your particular problem. No obligation whatever. Manufactured and guaranteed by Pyroil Company, 480 LaFollette Ave., La Crosse, Wisconsin, U. S. A.

CROSS SECTION OF A COST CUTTER

THE FLEXIBLE steel strips in the patented Thor 'Shock-Absorber' positively prevent ruinous vibration from reaching the motor.
Thor

THE PATENTED *Shock-Absorber* SPINDLE ON THOR PORTABLE GRINDERS

● When a powerful, portable electric grinder, whirring at thousands of RPM's, goes to work removing burrs from a casting or smoothing a weld there is bound to be terrific vibration. The problem is to prevent this vibration from reaching the motor so that the lead wires to the commutator do not crystallize, break and cause motor burnout.

Thor Engineers went to work on the problem. They developed the Thor 'Shock-Absorber', a two-piece shaft joined with flexible steel strips, that absorbs and STOPS all vibration at the spindle . . . before it reaches the motor! With this new design the use of portable grinders on production becomes practical; frequent motor burnouts are eliminated; maintenance is reduced. There may be a place in your plant where you can save time and money by the use of these cost cutting tools. For details write:

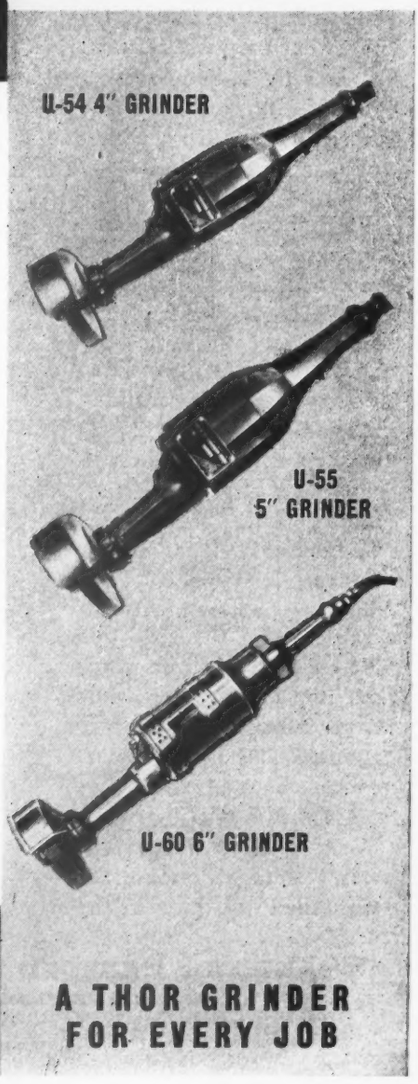
"MOTOR DESIGN"
THOR Armatures—triple-insulated, hand-wound and formed, are insurance against grounds, shorts and open circuits.
THOR Commutators—built as separate units on a brass sleeve instead of steel, eliminate high bars and floating segments.

INDEPENDENT PNEUMATIC TOOL CO.
600 WEST JACKSON BOULEVARD · CHICAGO · ILLINOIS
New York Pittsburgh Detroit St. Louis Los Angeles

TOOL MAKERS Thor SINCE 1893

PORTABLE ELECTRIC TOOLS

UNIVERSAL ELECTRIC GRINDERS



A THOR GRINDER FOR EVERY JOB

AGAIN UNBRAKO steps ahead with a New Idea!

Heretofore there has never been a positive way of locking a Set Screw; yet if it works loose there's no telling what may happen.

We licked the problem by simply knurling the two top threads of the "UNBRAKO," as shown.

This Knurling raises sharp prongs all around the edge of the thread which dig right into the threads of the tapped hole when the "UNBRAKO" is being tightened up, so it can't possibly work loose.

Tests have proven and our customers, who have already bought about 2,000,000 of them, corrobrate that the "UNBRAKO" *Self-Locking Set* positively won't budge once it's tightened up.

This time it's

UNBRAKO

Self-Locking Hollow Set Screw

FIG. 1564

Pat. Applied for

Send for Free Sample

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS

JENKINTOWN, PENNA.

BOX 546

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

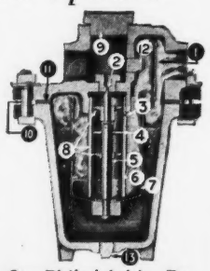
The New COCHRANE STEAM TRAP

A bucket-type trap designed for straight-line installation; makes inspection possible without disturbing piping or connections.

Only 2 moving parts—the bucket and the valve. Quick, positive action makes wire drawing impossible. Capacities are scientifically determined. Write for Publication No. 2663 telling how to select trap sizes.

Details of Construction and Operation

1. Straight - Through Pipe Connections
2. Valve and valve seat of hardened stainless steel
3. Air Vent
4. Knock-Off Arm of Stainless Steel
5. Bucket Stem of Stainless Steel
6. Center Tube Water Sealed to prevent blowing Steam
7. Drawn Copper Bucket
8. Discharge Tube and Guides of Bronze
9. Plug Opening for Easy Access to Seat
10. Trap can be disassembled without interfering with piping
11. Serrated Surface to Grip Gasket
12. Thermostatic Air Vent when required may be easily inserted in place of plug
13. Drain Plug



Cochrane Corporation, 3124 North 17th St., Philadelphia, Pa.

COCHRANE

VALVES • TRAPS • SEPARATORS • SPECIALTIES

DUST CONTROL

TWO PANGBORN DUST COLLECTORS RECENTLY INSTALLED ON ROOF OF BUICK MOTOR CO., FLINT, MICH.

PAYS DIVIDENDS THRICE!

1 **EFFICIENCY** Better and quicker work is accomplished when plant conditions are clean and free from dust. More work is produced per hour.

2 **PROTECTION** Dust control prevents explosion hazards, reduces wear and tear on equipment, and eliminates soiled stock losses.

3 **SALVAGE** Dust collection often turns out to be PAY DIRT in the form of salvaged valuable materials. Loss is eliminated by trapping dusts that have commercial value at their very source.

There are proper size Pangborn Dust Collectors for every requirement. We will gladly give you the benefit of our thirty years' experience if you will write us regarding your present conditions. Send for our free booklet, "Industrial Dust Control Through Exhaust Systems".

PANGBORN CORPORATION • • • HAGERSTOWN, MARYLAND

"World's Largest Manufacturers of Dust Control and Blast Cleaning Equipment"

PANGBORN

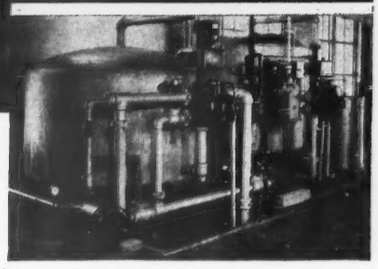
RAW WATER BLOCKS STEAM POWER WHERE POWER BEGINS

Here is a picture of boiler "guts" . . . the steel tubes of a modern steam power boiler. In these tubes power begins.

They contain water and steam. Heat, rising from the furnace below, surrounds the outside surface of each tube. The ability of the boiler to produce steam depends on getting the heat through the tube wall and into the water.

Unfortunately most raw water contains dissolved solids that form a stony lining (called scale) on the inside surface of the tubes, which impedes passage of heat through the tube wall. The effect is to waste fuel, increase steam costs. Worse still, if the condition continues, the tube wall will overheat, and pressure within will bulge the metal at that point. The effect can be seen in the "bagged" tube pictured below.

The bulge may increase until the metal gives way . . . the tube bursts, creates havoc. Section of "blown-out" tube shown below.



Typical fully automatic Permutit industrial water conditioning installation.

Permutit Water Conditioning continuously maintains, inside the boiler, water that will neither deposit scale of any kind nor corrode heating surfaces. A method of accomplishing this is selected according to the economic and technical requirements of the case in hand.

Throughout industry Permutit Water Conditioning stops water troubles. More than 25,000 installations in hundreds of industries all over the globe attest this. Water conditioning lowers costs, improves product quality, usually pays for itself in two years or less. For copies of Permutit bulletins use the coupon at right. Address The Permutit Co., Dept. R, 330 West 42nd Street, New York City.

Permutit
Water Conditioning

THE PERMUTIT CO., Dept. R, 330 West 42nd Street, N. Y. C.

(Please check)

☐ Please send me literature on Industrial Water Conditioning.

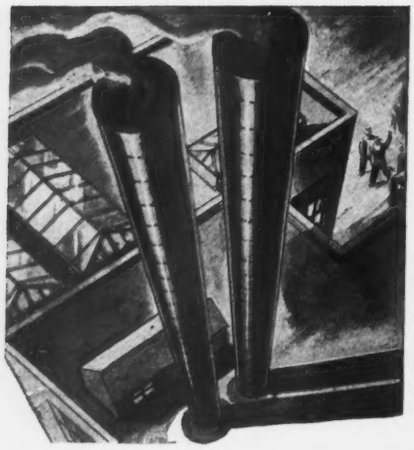
☐ I am interested in water conditioning for my home.

Name.....

Address.....

City.....

Business.....
(State nature of business)



Here's Paint

that has what it takes ...to make paint LAST

Any industrial paint that can protect outdoor structures for nine or ten years (and even longer) has what it takes to seal a surface securely against those paint-wreckers — heat and cold, water and ice, sulfurous and other industrial gases.

Dixon's Industrial Silica Graphite Paints have that record — which is not even surprising when you remember the properties of natural flake graphite. It is inherently water repellent and chemically inert. It plates metal with a sheath of microscopic scales that overlap shingle-like and adhere with extreme tenacity. Combined by nature with silica, this pigment has no peer in all the world. As processed by the Joseph Dixon Crucible Co. and put up in pure boiled linseed oil, here is an industrial paint that proves its worth in low cost per square-foot-year.

Write for Master Specification BI44 and chart showing the fourteen available colors including aluminum.

Paint Sales Division

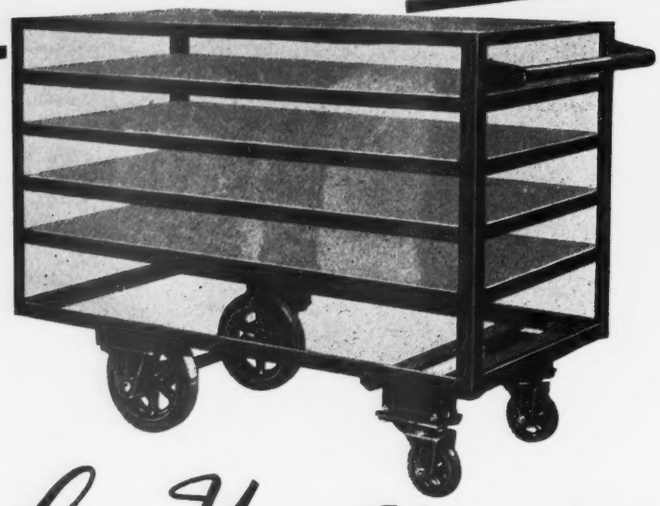
JOSEPH DIXON CRUCIBLE COMPANY

Established 1827 — Jersey City, N. J.

DIXON'S INDUSTRIAL SILICA-GRAPHITE PAINT

7688

40 SQUARE FEET OF SHELF SPACE ON Wheels



Can You Use It?

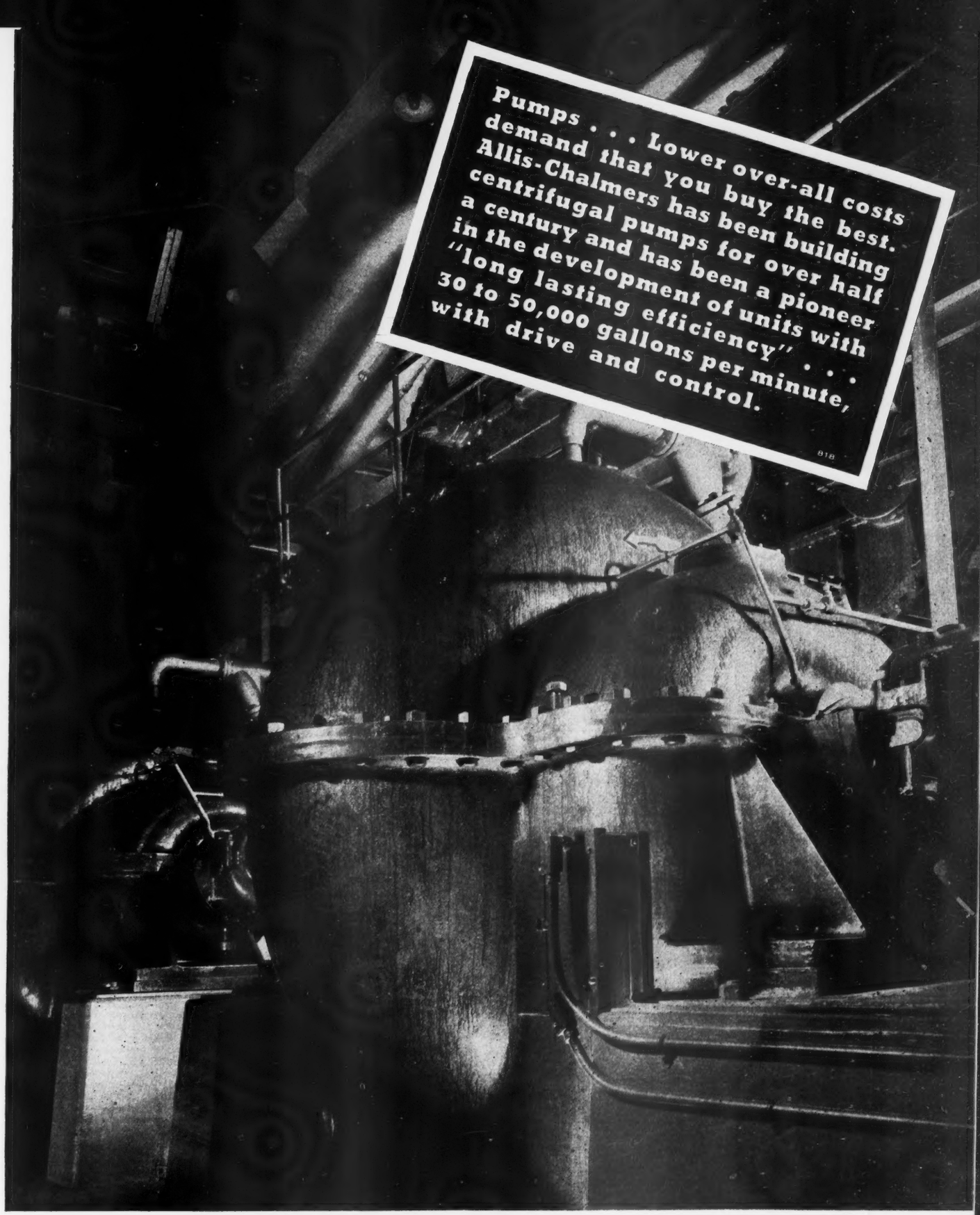
• There is no regular name for this truck, but there are a hundred uses. Call it a "Shelf Truck" and imagine it in your shop or plant—probably most often handling your products at various stages of processing—Quickly, smoothly and steadily rolling on to the next operation.

This Service "Shelf" Truck can be made with many shelves or few, spaced apart according to what you want it to carry—and always the number of shelves mulitiplies the floor space it covers. In the standard waist-high model shown, the five 2x4 foot shelves multiply the 8 square feet to 40—and the same plan could be used for a truck of any size to fit your special needs—A great boon to a crowded shop, a floor saver, and a work organizer.

Of course, the running gear is Service Frictionless Caster—two swivel, and two rigid—all rubber tired (Enduro) and Alemited. Can you use it?—or one enough different to suit your special needs? Write us.

Service CASTER & TRUCK CO.

505 N. Brownswood Ave., Albion, Michigan


Pumps . . . Lower over-all costs demand that you buy the best. Allis-Chalmers has been building centrifugal pumps for over half a century and has been a pioneer in the development of units with "long lasting efficiency" . . . 30 to 50,000 gallons per minute, with drive and control.
818

When you need pumps from 30 to 50,000 gpm or more

EQUIPMENT ENGINEERS TO INDUSTRY

ALLIS·CHALMERS

MILWAUKEE WISCONSIN

UNCOVER THE FACTS!

DO TWO MEN'S WORK

in less than

ONE MAN'S TIME

Experience has proved that it does not pay to utilize man power in handling loads of 500 pounds or less . . . The Lo-Hed Quarter-Ton Hoist—the original electric hoist of its capacity—was built specifically for loads too heavy for one or two men to handle safely, profitably.

The new Lo-Hed catalog shows you its 21 features, tells about the 96 other *standard* Lo-Hed Hoists. Send for a copy.

AMERICAN ENGINEERING COMPANY
2426 Aramingo Avenue, Philadelphia, Penna.

A-E-CO LO-HED Hoist

Other Products: A-E-CO Taylor Stokers, A-E-CO Hele-Shaw Pumps, Motors and Transmissions, A-E-CO Marine and Yacht Auxiliaries.

Gentlemen: Please send me your complete new Lo-Hed catalog including an outline of how to easily and properly select a hoist for any requirement.

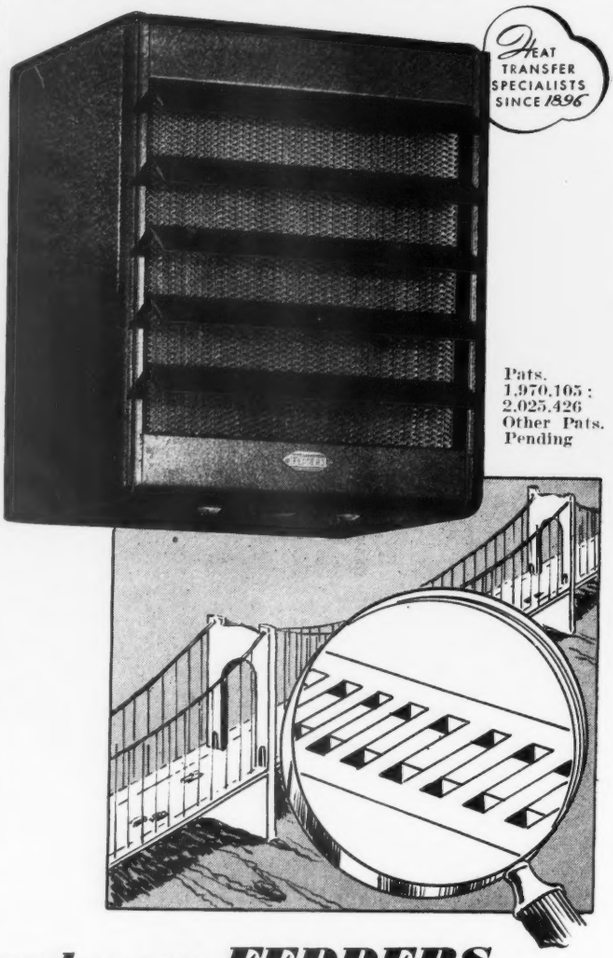
*Name of Company*_____

*Company Address*_____

*Your Name*_____

*Your Title*_____

BIG BRIDGES
are Protected Against
EXPANSION



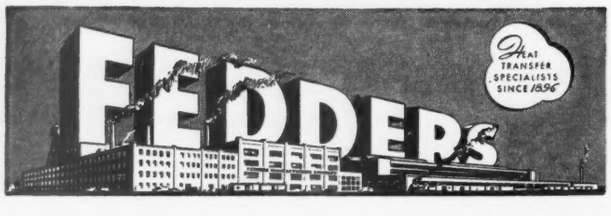
Pats. 1,970,165; 2,025,426 Other Pats. Pending

***and so are* FEDDERS UNIT HEATERS**

Expansion stresses are far more severe in Unit Heaters than in bridges because of wider and more sudden temperature changes. Fedders Unit Heaters have exclusive full-floating telescoping mountings which permit free movement of the heating element vertically in cabinet and also protect it from torsional stresses. Tubes having 3 to 1 streamline ratio and individual convoluted fins allow each tube to "give" laterally, thus relieving differential expansion stresses within the element. This also allows the use of curved, non-diaphragmatic headers, assuring a stable heating element. Fedders convoluted fins are saddled over sides of tubes, to eliminate heat expansion stresses between fin and tube, thus maintaining a permanent thermal bond. Accordion design of fins eliminates stresses between bonding points.

Quieter operation and handsome, sturdy mono-piece cabinets make Fedders Unit Heaters ideal for commercial as well as industrial applications. Write for Bulletin 572.

FEDDERS MANUFACTURING CO., Buffalo, N. Y.
Air Conditioning Units—Blast Heating and Cooling Surfaces



Kills INDUSTRIAL FIRES FASTEST

. . . yet harmless to men or materials

GET the jump on fire. Snuff it out *fast!* Use the fastest known extinguishing agent—LUX carbon dioxide snow-and-gas.

Your Lux extinguisher will snuff out the most dangerous industrial fires with astonishing ease and speed. Lux snow does no damage to delicate equipment, no harm to workers. No "extinguisher-damage" or mess to be cleaned up.

For all ordinary or extraordinary industrial fire hazards, insist on Lux. It's your finest protection.

LUX SNUFFS OUT FIRE

Complete details available in new booklet "Instant Death To Any Fire." *Mailed free on request.*

● A Built-In LUX System is recommended for severe and concentrated hazards. It delivers a heavy barrage of LUX carbon-dioxide snow directly to the heart of the fire area.

Protects lacquer processes, storage rooms for flammables, and generators, transformers, etc. Operates automatically or manually.

Write for new brochure, "LUX Makes The Difference."

Walter Kidde & Company, 32 West Street, Bloomfield, N. J.

REDUCE

THE COST OF HANDLING AND STORING PARTS

with

DEMONSTRATION BOX SENT FREE ON REQUEST

A-S-E STACKING BOXES

• Production costs are lowered when A-S-E Stacking Boxes are used. Small parts are handled faster and more safely. Storage space is more effectively used. Stacking Boxes can be used on roller or belt conveyors, moved by cranes, trucks, or on skid platforms. They are sturdily built and withstand years of rough treatment.

The stacking rim on A-S-E Stacking Boxes is *effective on all four sides.* Boxes can be stacked as high as desired and will not telescope or become unstacked from vibration. Their uniform size and strength eliminate strain and the possibility of accidents.

A-S-E Stack *Units* have the latest type of sloping bin front. They will stack interchangeably with A-S-E Stacking Boxes of the same size. Stack Units are especially suited for store rooms and for assembly work where parts must be kept within easy reach of workers without becoming mixed.

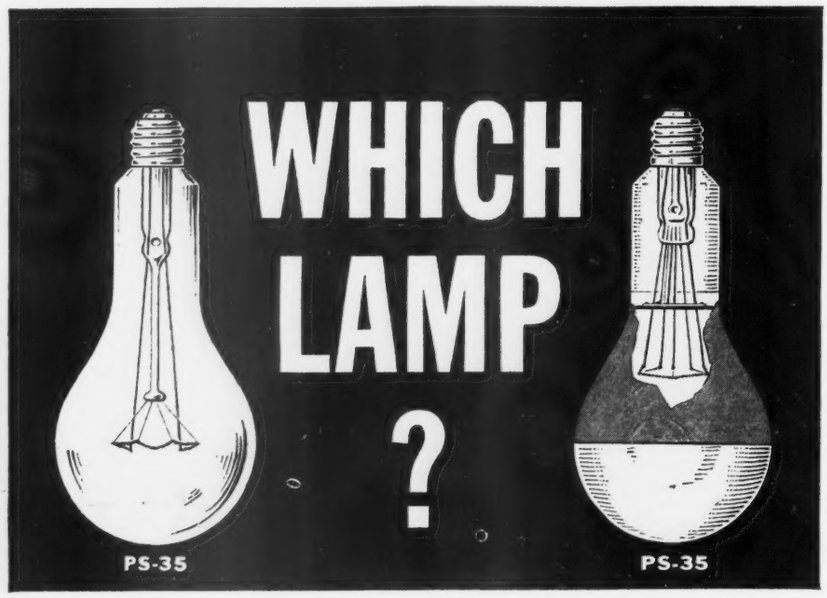
Mail the coupon today.

ALL-STEEL-EQUIP CO.

INCORPORATED

501 Kensington Ave., Aurora, Illinois

ALL-STEEL-EQUIP Co.
501 Kensington Ave., Aurora, Ill.
I am interested in lowering the cost of handling and storing small parts. Send complete information about Stacking Boxes and Stack Units ( )
Send sample Stacking Box ( ) Stack Unit ( )
Name .....
Address .....
City ..... State .....



Here are two lamps. An ordinary incandescent lamp and a Birdseye Inside-Silvered Reflector Lamp. They are identical in three important respects:

- **BOTH ARE THE SAME PHYSICAL SIZE**
- **BOTH PROVIDE COMPARABLE LIGHTING LEVELS ON THE WORK PLANE**
- **BOTH ARE APPROXIMATELY THE SAME PRICE**

Here similarity ends. Compare these specifications. Which lamp is the better buy?

ORDINARY INCANDESCENT LAMP	BIRDSEYE REFLECTOR LAMP
1. Consumes 300 watts.	1. Consumes 200 watts.
2. Requires separate reflector with an exposed surface to re-direct rays on to the work plane. Constant maintenance required to prevent heavy loss of light.	2. Reflector maintenance completely eliminated. Inside silvering forms a reflecting surface that cannot be dulled by dirt, grime, chemical fumes, or smog.
3. Replaced when lamp burns out with new lamp but in same old light absorbing reflector.	3. Replaced after 1000 hours or more with new lamp having brand-new silvered reflecting surface.

Birdseye Reflector Lamps, compared to any incandescent lamp in the market, are the cheapest to own. The remarkable savings they produce, plus infinite care in workmanship, plus tested materials, would justify premium prices. But Birdseye prices are now at truly competitive levels. You can make your own tests easily. Our introductory test assortment with photometric curves and engineering data will be sent prepaid for $5.00 ($9.00 list value). Write: Birdseye Electric Co., 100 East 42nd Street, New York, N. Y.

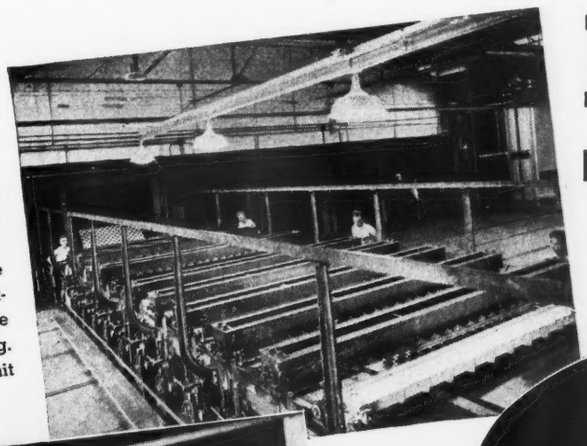
BIRDSEYE REFLECTOR LAMPS

100 East 42nd Street BIRDSEYE ELECTRIC CO. **New York, N. Y.**

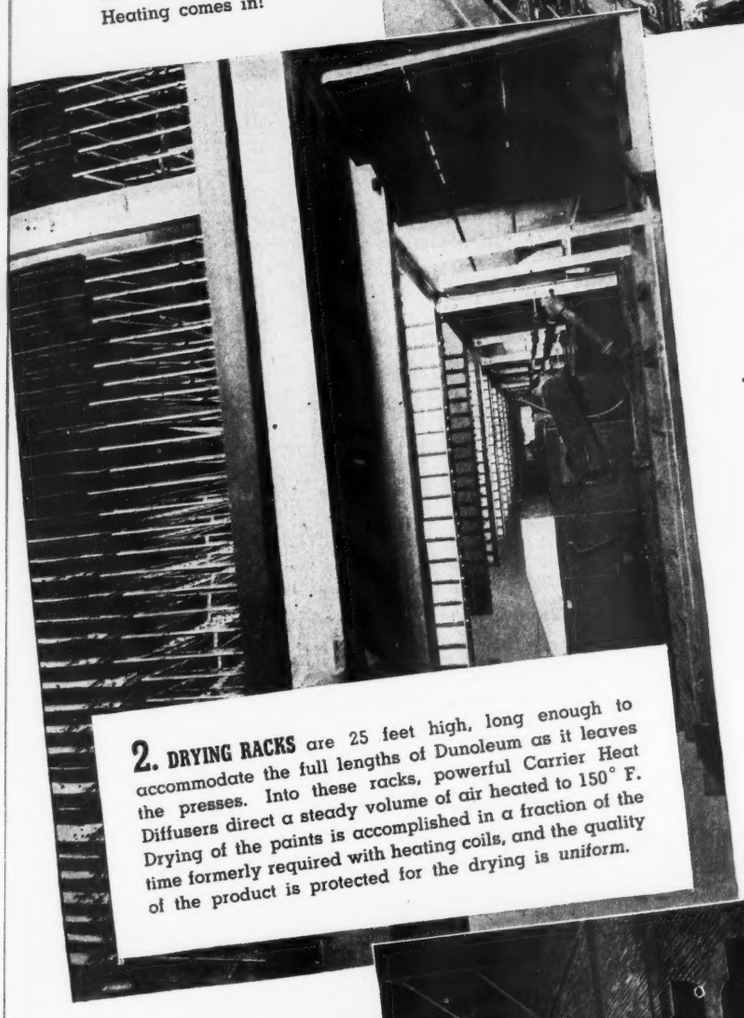
Factory: Gloucester, Mass.

Reg. U. S. Pat. Off.

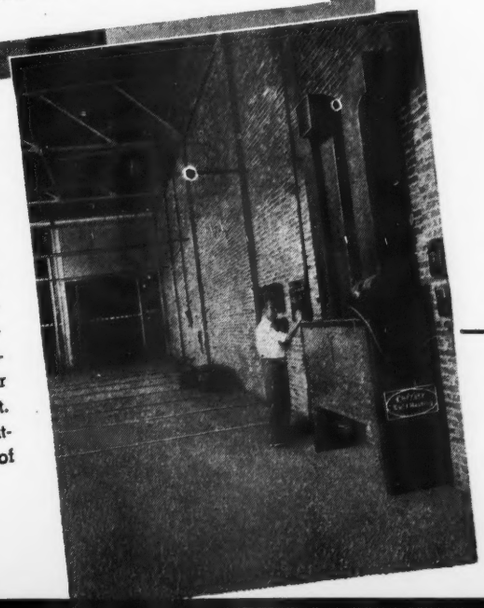
J. C. DUNN & COMPANY, Camden, N. J., Reduces Processing Time WITH Carrier Unit Heating



1. PRESSES LIKE THIS print Dunoleum — all in one operation. See the plain, felt-base material entering the press at the right side of the picture? By the time it leaves the far end of the press, the colors and patterns are complete—and the Dunoleum is ready for drying. That's where Carrier Unit Heating comes in!



2. DRYING RACKS are 25 feet high, long enough to accommodate the full lengths of Dunoleum as it leaves the presses. Into these racks, powerful Carrier Heat Diffusers direct a steady volume of air heated to 150° F. Drying of the paints is accomplished in a fraction of the time formerly required with heating coils, and the quality of the product is protected for the drying is uniform.



3. ANOTHER VIEW in the J. C. Dunn & Company plant, showing two drying racks, and the Carrier Heat Diffuser used for heating the print room. Since the first trial installation two years ago, J. C. Dunn & Company has installed these compact economical units throughout the entire plant—both for processing and for comfort. Proof that Carrier Unit Heating is the modern method of industrial heating!

Production Costs Lowered, as Manufacturer of Dunoleum Replaces Coils with Carrier Heat Diffusers

● One of the simplest plant changes you can make is to replace your direct radiation heating system with Carrier Unit Heating. No building alterations are necessary—you use the same steam lines, installing the Unit Heaters in convenient locations. Because they direct the heat into the working zone—less heating units are required. And whether you select the smaller, Kroy type of Carrier Unit Heater, or the larger Carrier Heat Diffuser used by J. C. Dunn Co.—you can be sure of economical, trouble-free operation.

Carrier Unit Heaters are built to endure! All heating coils, for example, are non-ferrous, and employ the famous Carrier return bend principle which eliminates strains due to expansion and contraction. All joints are brazed—never screwed. And the fan assembly is so carefully balanced that power costs are reduced as much as 50%—and noise and vibration reduced to the smallest practical value.

Whether your problem involves heat for processing or for comfort, Carrier Unit Heaters will do the job efficiently and economically. Many companies, in fact, report savings of 25% in fuel costs alone after replacing direct radiation with Carrier Unit Heating. There's no obligation in learning more about Carrier Unit Heating —why not call your Carrier representative today?

FOR COMFORT OR PROCESSING—

Carrier Unit Heating

CARRIER CORPORATION, Syracuse, N. Y., Desk 908

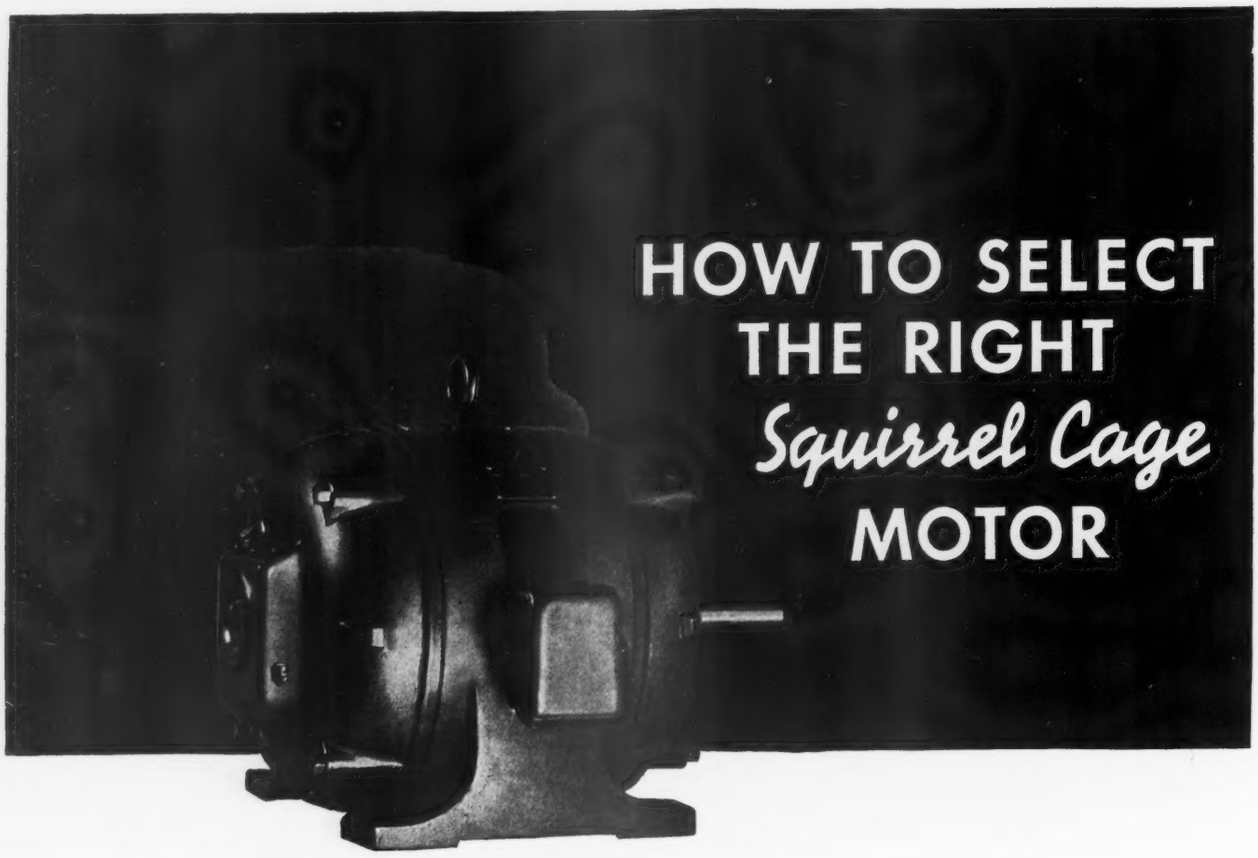
Without obligation, send me complete information on Carrier Unit Heating.

Name.....

Company.....

Address.....

City.....



Each one of the four distinct types of Squirrel Cage Motors built by Century is designed with individual characteristics that are best adapted to economically meet the starting and running requirements of the driven load.

Type SC... *Normal Starting Torque—Normal Starting Current*... Balanced design—no one characteristic is over developed at the expense of another. The popular motor for general purpose applications—particularly for precision machine tools.

Type SCN... *Normal Starting Torque—Low starting Current*... This type motor is popular for general purpose applications where it is necessary that across-the-line starting current be within N. E. M. A. and E. E. I. limits.

Type SCH... *High Starting Torque—Low Starting Current*... This motor is popular for driving hard to start loads such as Freon Refrigeration Compressors, Plunger pumps, etc., with starting current across-the-line within N. E. M. A. and E. E. I. limits.

Type SCT... *High Torque—High Slip*... For high inertia, and other industrial loads such as Punch Presses, shears, slotters, cranes, hoists, gates. They can all be furnished in open, splashproof, or totally enclosed construction.

Century Engineers will answer your questions about selecting the right motor to meet your load requirements and prove most economical in the long run. More than 34 years' experience plus thorough knowledge of application requirements.

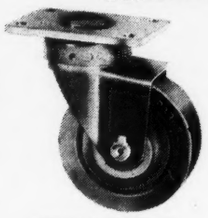
CENTURY ELECTRIC COMPANY
1806 Pine Street • • • St. Louis, Missouri
Offices and Stock Points in Principal Cities

Century MOTORS

Increase SAVINGS

WITH DOUBLE BALL BEARING SWIVEL

DARNELL CASTERS & WHEELS



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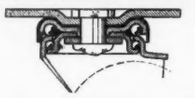

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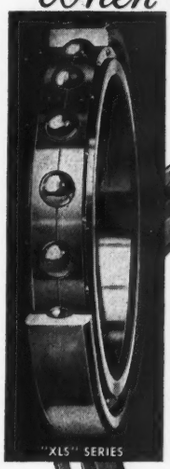

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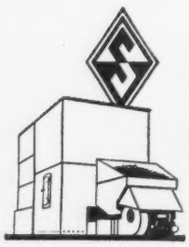

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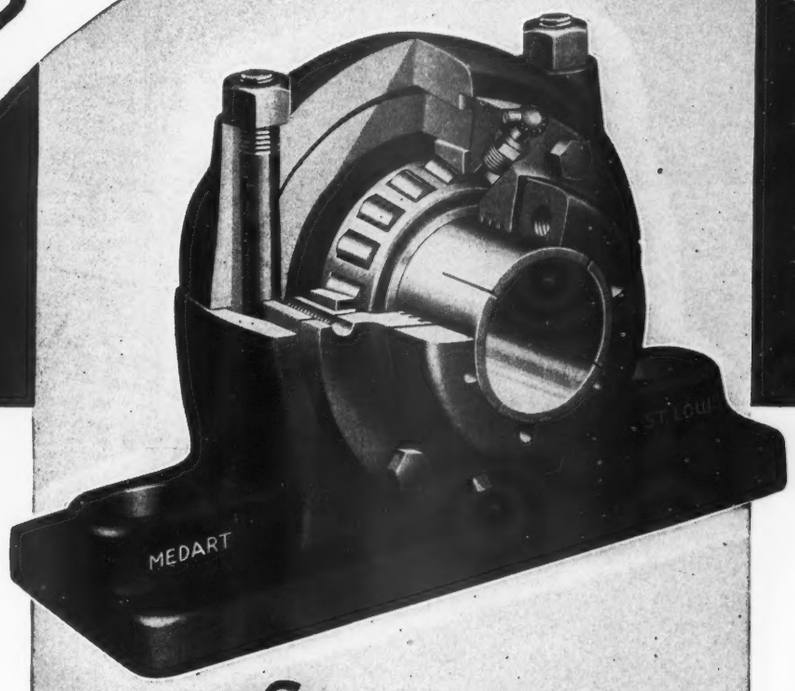

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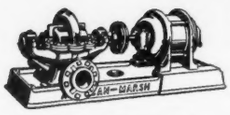

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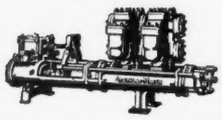

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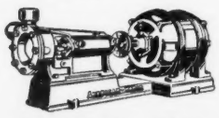

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A REAL TEST OF PAINT PERFORMANCE

Note the complete absence of blistering, peeling, scaling or discoloration two years after exposure to conditions described below.

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That is clearly shown in the photograph above, taken two years after painting. Despite the long exposure to moisture there is no evidence of blistering, peeling, scaling or saponification, nor has the paint yellowed—it still retains its bright whiteness, lighting up the entire room.

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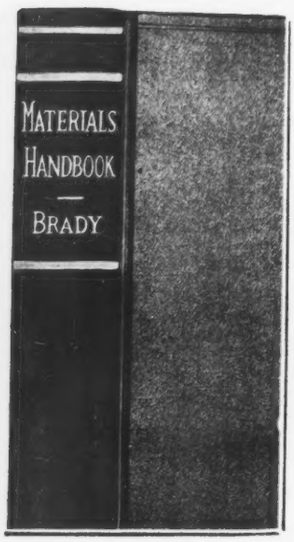

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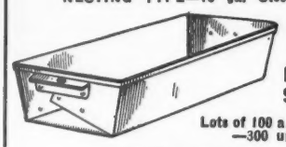

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$2,500 to $25,000

This thoroughly organized advertising service of 27 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details.

R. W. BIXBY, INC.
276 Delward Bldg., Buffalo, N. Y.

EXECUTIVES
OFFICE — TECHNICAL — SALES

We render a personalized service to employers whose needs are above the average.

Our applicants are all investigated as to past experience, ability and moral habits.

We invite employers to personally discuss their employment problem with us.

A. J. McCOY & ASSOCIATES
INCORPORATED
EMPLOYMENT BROKERS
140 So. Dearborn Street, Chicago, Ill.

Motion and Time Study Training

Effective factory operation demands men trained in the new methods of cost reduction through job analysis and work simplification. Methods Engineering positions await trained men. Write for Booklet describing our home study training courses in Methods Engineering, Motion and Time Study, and Time Formula Derivation.

Methods Engineering Council Extension
Wood & Franklin Sts., Pittsburgh, Pa.

EXECUTIVES AND TECHNICAL MEN

Contact selected employers in any territories through our confidential and effective methods. Established 22 years. Write.

THE NATIONAL BUSINESS BOURSE
H. H. HARRISON, Director
20 W. Jackson Blvd., Chicago

YOU ARE ONE

of 25,000 readers of FACTORY MANAGEMENT and MAINTENANCE.

Your problems of plant management, production and maintenance—business or individual—are duplicated with *other* readers BUT—

Still *OTHER* readers can provide the solution of your problem if they *know what it is!*

Tell them! Here! Through classified advertising in the Searchlight Section of "Factory"—*your* business paper and *theirs.*

—TRANSFORMERS—

A Complete Stock. **Prompt Shipment.**

3—500 KVA Wagner Transformers, 60 cycle, 4000-460 volts **$910.00** EACH

We Rewind, Repair and Redesign all Makes and Sizes.
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 132-D

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M CINCINNATI, OHIO

SAVE 60%

REBUILT
SPEED REDUCERS
UP TO 200 HP.—ALL MAKES IN STOCK
REEVES DRIVES
No. 000 to No. 8 IN STOCK—ALL TYPES

All units like new—Guaranteed
Over 750 in stock—Send for our lists.
We buy your surplus transmission

PATRON MILLWRIGHT & TRANSMISSION CO.
158 GRAND ST. NEW YORK CITY

FOR SALE
IMMEDIATE DELIVERY
Reasonably Priced

Air Compressors—Conveyor Type Japan Baking Ovens—Metal Washing Machines—Impregnating Equipment—Sheet Metal Working Machines—Hydraulic Presses—Sullivan & Buffalo Vacuum Pumps—Air Filters—Hydraulic Pumps — Kingsbury Drillers — Anderson Tappers — Carton Sealing Machines—Overhead Conveyors—Paper Tube Machines—Wood Working Machines—Artos Wire Machines—Drill Presses—Sand Blast Machines—Electro Platers—B & S Hand Screw Machines—Lathes—Millers—Spot Welders — Bench Conveyors — Grinders — Buffers — Planers — Slitter — Punch Presses — Gas Furnaces — Spray Booths — U.S.M.C. & Peerless Eyelet Machines—Condenser and Coil Winders — Factory Chairs — Steel Shelving — Factory Trucks — Overhead Cranes—Electric Time Clocks—Electrical and Testing Equipment.

This is a Partial List—Catalog on Request

ATWATER KENT MANUFACTURING COMPANY
4700 Wissahickon Ave. Phila., Pa.

ELECTRICAL MACHINERY

Motors and Generators, A.C. and D.C. for sale at Attractive Prices. Large Stock. New and Rebuilt All Guaranteed. *Write for Stock List and Prices.*

V. M. NUSSBAUM & CO.
FORT WAYNE, IND.

Idle—surplus equipment is a double expense

—it represents both inactive capital and wasted space

Other readers of this publication may want just what you no longer need

Why not tell them what you have available through advertising in the

SEARCHLIGHT SECTION

of this paper

• GUARANTEED REBUILTS •

SPECIAL 2—1250 KW CONDENS. TURBO GENERATOR SETS ALSO—1250 KVA. 2300-3-60 CONDENSER

MG SETS
2-750 KW Sync.—125 v.
1-225 KW Syn., compl.
1-150 KW G.E. Syn.
1-100 KW Sync. compl.

SYNCHRONOUS MTRS.
1-1000 hp Cr.Wh. 600 rpm
1-750 hp E.Mch. 514 rpm
1-315 hp G.E. 600 rpm
1-200 hp Cr.-Wh. 600 rpm
1-200 hp Wgse. 225 rpm
1-150 hp Burke 600 rpm
1- 75 hp G.E. 600 rpm

AC GEN.
1-1250 kw Ideal 1200 rpm
1-1000 KW G.E. 257 rpm
2-750 KVA 200 rpm
1-750 KW Cr.Wh. 600 rpm
1-500 KW E.Mch. 514 rpm
1-375 KVA G.E. 225 rpm
(Many in smaller capac.)

SLIPRING MOTORS
1-500 hp Al. Ch. 450 rpm
2-300 hp Wgse. 360 rpm
3-200 hp Al.-Ch. 720 rpm
1-200 hp Burke 900 rpm
1-200 hp G.E. 600 rpm

Write for Large Squirrel Cg. List

SURFACE CONDENSER
4000 Sq. Ft. Worthington

COMPLETE STOCK SMALL EQUIPMENT
New Catalog on Request

CHICAGO ELECTRIC CO.
1326 W. 22nd St. CHICAGO, Ill.

MOTORS
3 Phase, 60 Cycle

H.p.	Type	Speed
1500 G.E., syn.		180
1500 West. sl. rg.		440
1000 West. synch.		900
850 West. sl. rg.		710
500 Allis. Ch. sl.rg.		500
450 West.sl.rg.		875/700
400 G.E. sl. rg.		390
400 West. sl. rg.		450
375 G.E. syn.		600
350 Cr. Wheel syn.		720
300 G.E. syn.		600
300 Al. Ch. sl. rg.		585
250 West. sl. rg.		500
250 G.E. sl. rg.		257
225 El. Mchy. syn.		450
225 G.E. sl. rg.		1800

DIESEL ENGINE GENERATOR SETS
200 H.P. McIntosh & Seymour, 8 cy. V-type Diesel, 500 rpm, direct con. 135 KW. D.C. G.E. gen. Note. Can furnish AC gen.

ROTARY CONVERTER
1—550 K.W. G.E. Type HCC, 600 v. D.C. 6 phase, 60 cycle, 1200 rpm.

CENTRIFUGAL PUMPS
2500 GPM. Delaval type 10, 159'-75 lb. 10", S. Stage, D. Suction.

Above are a few of our stock items

BELYEA CO., INC. 144 W. 18th St. New York City
REBUILT GUARANTEED

FOR SALE
1,000 KW TURBO GENERATOR

1—1,000 KW (80% P.F.) Westinghouse 60 cycle 2,400 volt 3,600 r.p.m. 220# turbo-generator, with direct connected exciter; at present 2 phase but will have rewound for 3 phase operation, if desired.

1—LeBlanc jet condenser for above.

This equipment is still on original foundation, is in excellent operating condition as shown by turbine insurance inspection reports on file, and will be demonstrated. Delivery f.o.b. cars, Winnetka, Illinois in Feb. 1938.

Detailed specifications on request. Address

H. L. WOOLHISER, City Manager
Winnetka Illinois

GREGORY HI-GRADE-REBUILT

MOTORS
GENERATORS
TRANSFORMERS
METERS, FANS,
PUMPS, ETC.

Always Dependable —Economical—

Money-Back Guarantee

We
- Sell
- Buy
- Rent
- Repair
- Exchange
- All Makes
- and Sizes

GREGORY ELEC. CO.
1606 South Wolcott Avenue
"formerly Lincoln Street"
CHICAGO

BARGAINS IN PULLEYS

250 Pulleys 6" to 128" diameter, various faces and bores; steel split, C. I. split. C. I. solid, for sale singly at one-half new list price or will accept offers for entire lot. Located Hartshorne, Oklahoma.

Write P. O. Box 3046, Houston, Texas

GOOD USED STEEL STRUCTURES

53'x84' 130'x230' 90'x160'
38'x140' 60'x300' 110'x400'

We Buy and Sell Steel Structures!

IRON AND STEEL PRODUCTS, INC.
CHICAGO (Hegewisch Sta.), Ill. SOUth Chgo. 9430
"Anything so long as it contains Iron or Steel"

New "SEARCHLIGHT" Advertisements

must be received by October 21st to appear in the November issue.

Address copy to the Departmental Advertising Staff
Factory Management and Maintenance
330 West 42d St., New York City

FOR IMMEDIATE SALE

Dismantled Steel Building Structure Sufficient Columns and Trusses to fabricate Steel Bldg. Approx. 128 ft. long, 55'2" wide, 15'3" high. Approx. 74 tons.

PRICED FOR QUICK SALE

RENTAL SERVICE CO., INC.
20th & Venango Sts. Phila., Pa.

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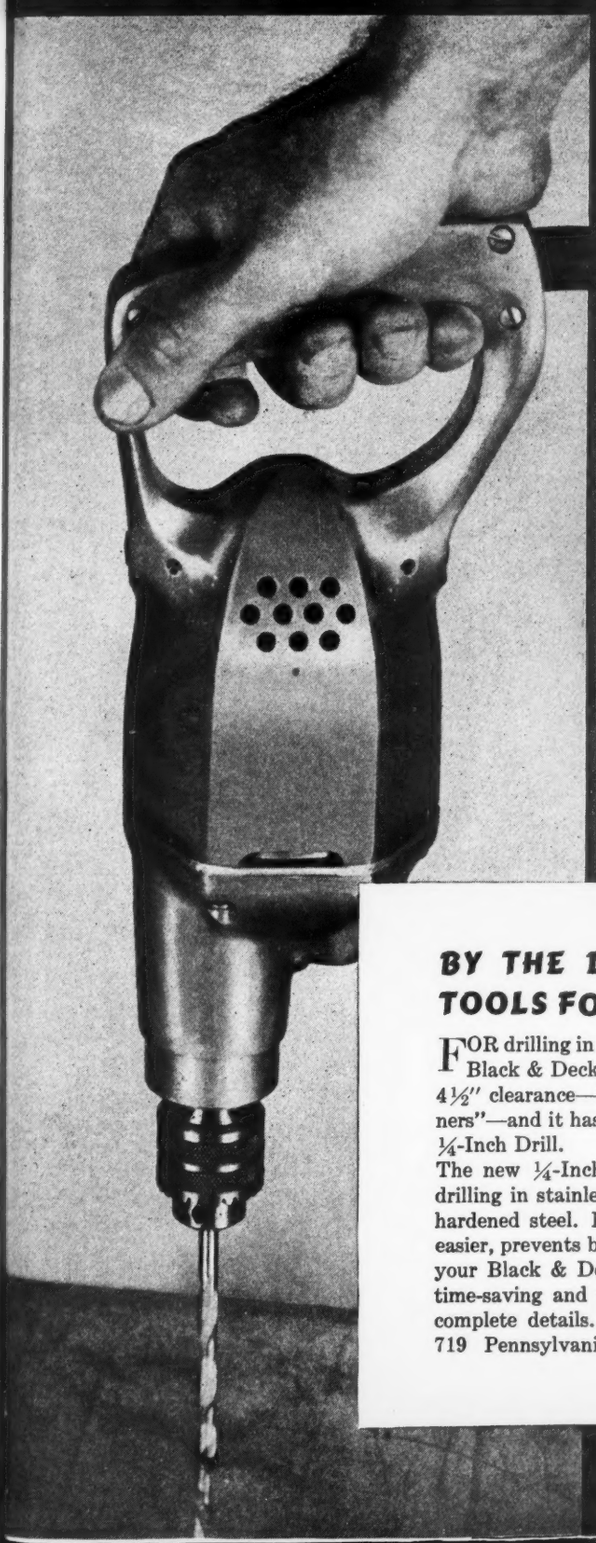
HELPING GOOD MECHANICS DO BETTER WORK



BY THE DEVELOPMENT OF 2 NEW TOOLS FOR SPECIAL TYPES OF JOBS

FOR drilling in awkward places—there's nothing like the new Black & Decker ¼-Inch Shorty Drill. Shorty requires only 4½" clearance—its right-angle drive will reach "around corners"—and it has the same speed and power as a conventional ¼-Inch Drill.

The new ¼-Inch Low Speed Drill is specially designed for drilling in stainless steel, monel metal, high carbon and case-hardened steel. Its slower speed (450 r.p.m.) makes drilling easier, prevents burned drill bits and lost production time. Ask your Black & Decker Jobber to demonstrate these two new time-saving and money-saving tools—or write for complete details. The Black & Decker Mfg. Co., 719 Pennsylvania Avenue, Towson, Maryland.

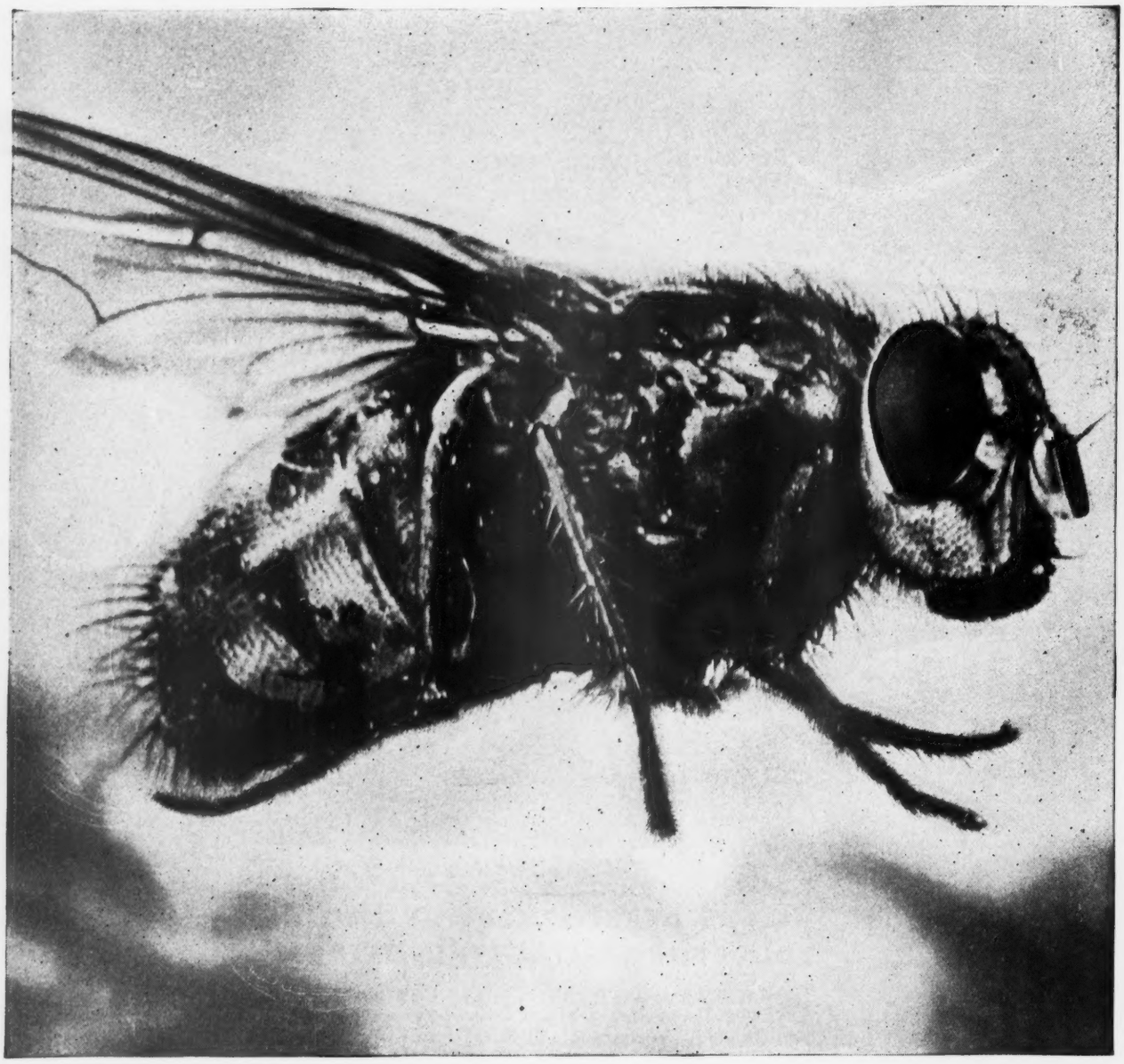
AUTOMOTIVE EQUIPMENT TIME PAYMENT PLAN

Black & Decker

World's Largest Manufacturer of

BLACK & DECKER

PORTABLE ELECTRIC TOOLS



Rubber—like sugar—catches more flies

A typical example of Goodrich product development

YOU remember the old saying—"Sugar catches more flies than vinegar." Catching flies is the job of Tanglefoot Company, makers of fly paper, so when they heard that a foreign product caught more flies than their own, they investigated and found the reason—rubber was part of the sticky material. But the method of using the rubber was a carefully guarded foreign secret.

Tanglefoot came to Goodrich with the problem. A Goodrich technical man went to work, developed a formula equal in every way to the foreign product, and then even helped Tanglefoot find the machinery needed for mixing the new ingredients.

With the Goodrich formula, the new Tanglefoot paper actually catches more flies, does not dry out, and ages so much more slowly that it lasts several times longer than any material used before. As a natural result, sales mounted.

Remember this, next time you buy anything made of rubber. Goodrich research is continuous. Applied to new problems it has developed tanks which hold even the most violent acids, rubber compounds so resistant to abrasion that they outwear steel 10 to 1, rubber colors and forms so attractive that they add new sales appeals to countless products. This same continuous research is also applied to standard products, with the result that Goodrich belting, hose and packing last far longer than used to be thought possible, and stand abuse and heats that would have ruined rubber a few years ago. Next time you buy mechanical rubber goods specify Goodrich, and save money. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

Goodrich

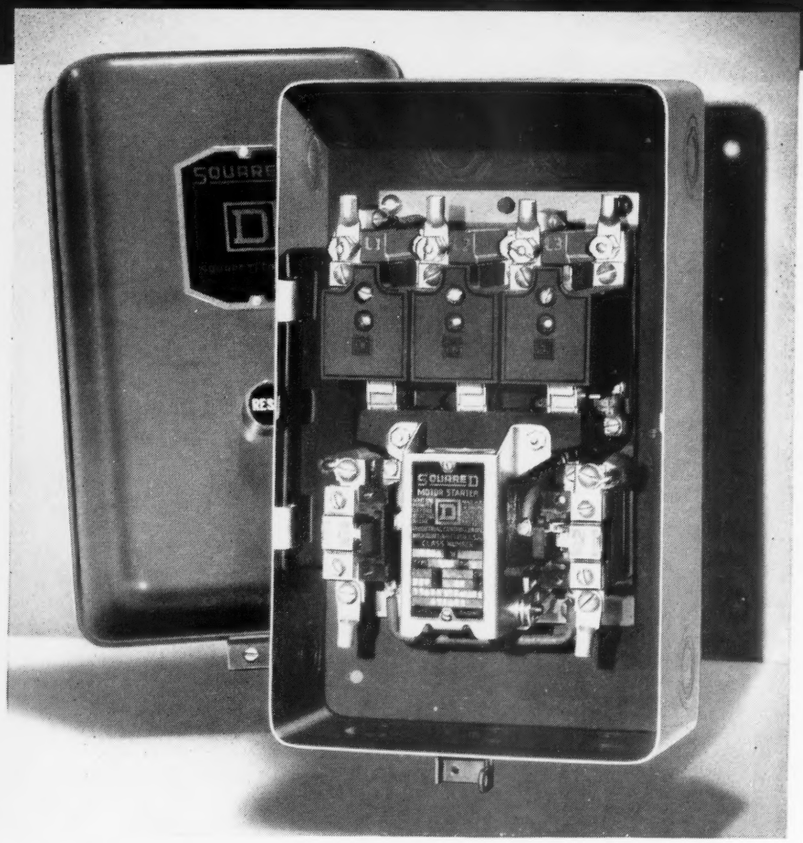
ALL *product problems* IN RUBBER

Another story of Goodrich development work appears on page 3

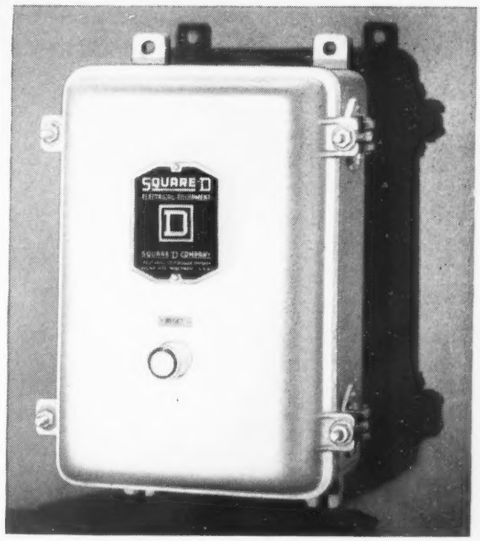
The new line of Class 8536 A·C.

SQUARE D AUTOMATIC STARTERS

is now available with all types of enclosures



Dust-Tight Enclosure



Water-Tight Enclosure

● The desirable features of this new line of starters were quickly recognized. Vertical operation with "E" type magnet. Silver to silver contacts. Extreme accessibility of all parts for inspection and maintenance. The Square D swing-out interior for easy wiring.

This new line is now complete in NEMA Sizes 1, 2 and 3—that is, polyphase ratings up to 30 H.P., 220 volts; 50 H.P., 440-550 volts.

These starters can also be supplied with the following special enclosures to meet all industrial applications—

Water-Tight—NEMA Type 4—with cast aluminum (or cast iron) enclosures, rubber gaskets, hinged covers and swing bolts to hold covers tight.

Dust-Tight—NEMA Type 5—Size 1 has cast aluminum enclosure. Sizes 2 and 3 have sheet steel enclosures with cover straps, swing bolts and felt gaskets.

Dust-Tight—NEMA Type 9—built according to Underwriters' specifications for Class II, Group G hazardous locations.

Explosion Proof—NEMA Type 7—built according to Underwriters' specifications for Class I, Group D hazardous locations.

Also combination starters with disconnect switch or circuit breaker; reversing starters or contactors; special control panels.

This new design is adaptable to meet all requirements for industrial applications or machine tool control.

CALL IN A SQUARE D MAN

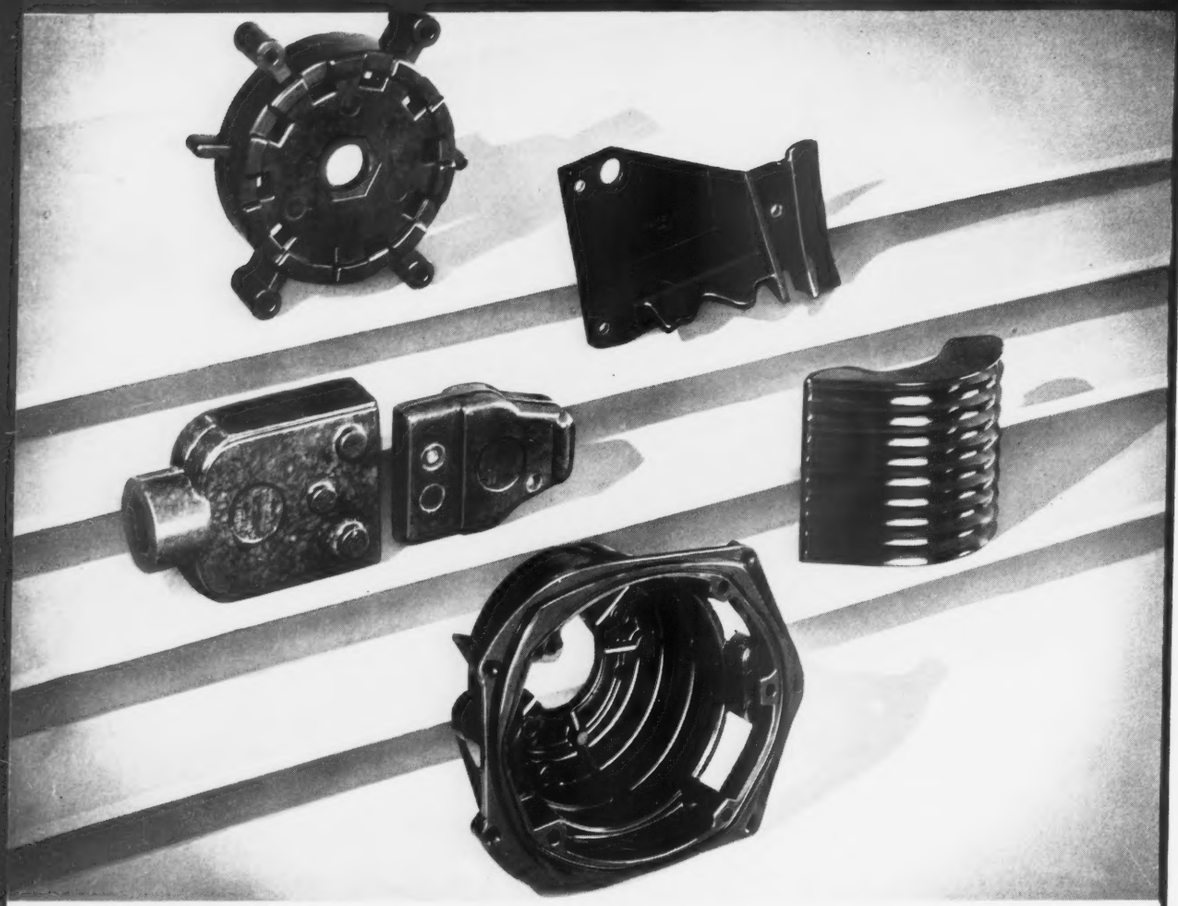
SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

SQUARE D COMPANY CANADA LTD. TORONTO, ONTARIO

Graded Impact Plastics...

THAT FULFILL VARIED DEMANDS



Switch base, machine part, power connector, refrigerator handle, and vacuum cleaner motor housing of, respectively, High Impact, Medium High Impact, Medium Impact, Improved Impact, and General Purpose Bakelite Molded.

FOR THE DESIGN of many products, the selection of suitable materials is largely governed by the *degree* of sturdiness required to meet specified service conditions. In Bakelite Molded, designers have available a complete and varied range of plastics, graded by degrees of impact strength.

General Purpose Bakelite Molded, for example, possesses ample strength to resist damage from normal handling in countless products. At the other extreme, *High Impact* Bakelite Molded provides more than 14 times greater impact strength. Intermediate types of Bakelite Molded possessing appropriate shock-resistance for many special uses, are: Improved Impact, Medium Impact and Medium High Impact Bakelite Molded.

In addition to selective impact strengths, these materials possess other desirable characteristics common to all types of Bakelite Molded: light weight, moldability, self-contained color and finish, electrical merits and resistance to moisture, heat, chemicals and solvents. We urge you to learn the full capabilities of these and other special types of Bakelite Molded.

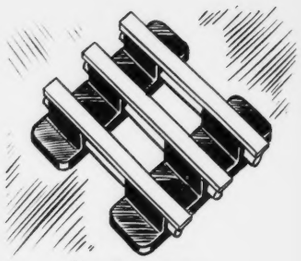
Write for our illustrated reference booklet 16M, "Bakelite Molded." On specific applications, we will be glad to recommend appropriate types of the material.

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N. Y.
BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin Street, Toronto, Ont.
West Coast: Electrical Specialty Co., Inc., 316 Eleventh Street, San Francisco, Cal.

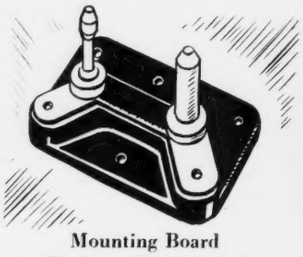
BAKELITE

REGISTERED U. S. PAT. OFF.

The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products.



Bus bar spacers
(*High Impact*)



Mounting Board
(*Medium High Impact*)

Cam Lever
(*Medium Impact*)

Ironer Feed Board
(*Improved Impact*)

Above are other appropriate applications of the four special impact types of Bakelite Molded.

THE MATERIAL OF A THOUSAND USES

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